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NATIONAL DAM INSPECTION PROGRAM. LAKE NAOMI DAM (NDS ID NUMBER --ETC(U)
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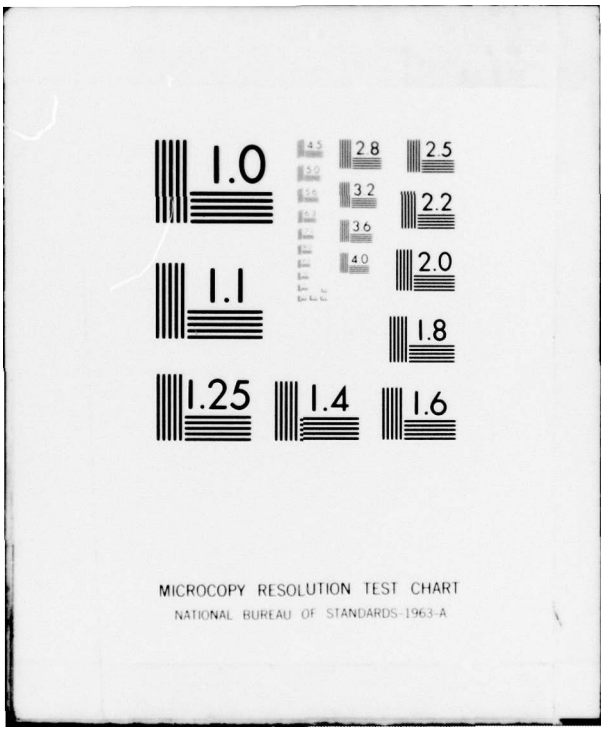
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DELAWARE RIVER BASIN
TUNKHANNOCK CREEK, MONROE COUNTY
PENNSYLVANIA
NDS ID PA. 00777
DER ID 45-1

LAKE NAOMI DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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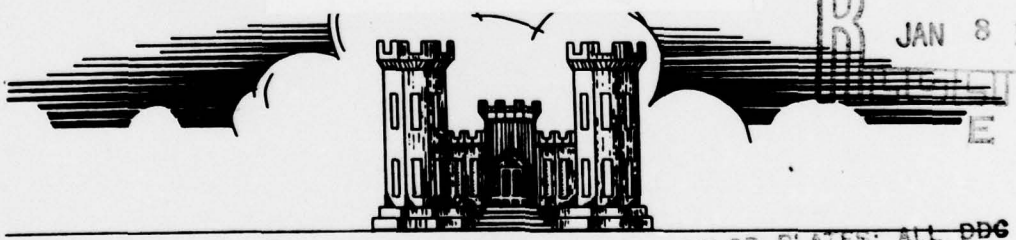


DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JULY 1979

(15) DACW31-79-C-0017

(1)

DELAWARE RIVER BASIN

LAKE NAOMI DAM
MONROE COUNTY, PENNSYLVANIA

(6) National Dam Inspection Program.
Lake Naomi Dam
(NDS I.D. Number PA 00777
DER I.D. Number 45-1),
Delaware River Basin, Tunkhannock Creek,
Monroe County, Pennsylvania.
PHASE I INSPECTION REPORT,
~~NATIONAL DAM INSPECTION PROGRAM~~

(12) 104

(10) John Baschuk, Jr

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(11) JUL[redacted]79

394157

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Lake Naomi Dam
County Located:	Monroe County
State Located:	Pennsylvania
Stream:	Upper Tunkhannock Creek
Coordinates:	Latitude 41° 6.5'
	Longitude 75° 28.5'
Date of Inspection:	10 May 1979

Lake Naomi Dam, originally built in 1895, is owned by the Pocono Pines Corporation and serves as a recreation lake for the organization. The dam was originally built in 1895 to serve as a recreation lake in the summer and an ice supply source in the winter. The dam is classified as a "Significant" hazard structure based on its potential to cause extensive property damage downstream and the remote chance for loss of life in the event of failure. The dam is also classified as an "Intermediate" size dam by virtue of its 1,492 acre-foot normal storage capacity.

On the basis of the visual inspection on 10 May 1979, and available documentation, the dam and its appurtenant structures are considered to be in good condition. Specifically, the inspection of the dam detected no significant problems with the embankment. The main spillway was assessed to be in fair condition. The auxiliary spillway, although not used very often, showed signs of leakage through the downstream toe and appears highly susceptible to erosion based on the visual inspection.

Since the very limited design documentation and visual inspection was insufficient to evaluate the stability of the dam and its appurtenant structures, particularly the auxiliary spillway, in accordance with all the provisions of the Phase I Inspection Program. Thus, additional investigations are required for a comprehensive evaluation of the dam.

The hydrologic and hydraulic calculations presented in Appendix C and discussed in Section 5 indicate that the spillway system for this structure is rated as "Inadequate".

Based on the findings presented in this report, the following recommendations are presented. The first three recommendations are considered critical and should be per-

professional engineer experienced in dam design. The following two recommendations are considered to be important and should be performed as soon as practical. Recommendations pertaining to the operation and maintenance procedures are described in the last paragraph.

1. A geotechnical investigation of the auxiliary spillway should be performed.

2. Pending the results of Recommendation 1, the spillway system should be reconstructed to meet current hydrologic/hydraulic criteria as determined from a detailed hydrologic/hydraulic analysis.

3. Trees, woody vegetation and debris downstream of the auxiliary spillway should be removed to improve hydraulic conditions.

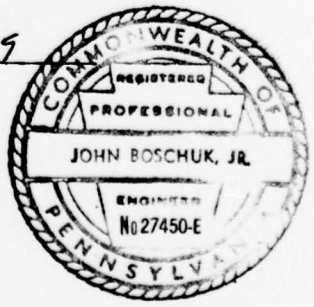
4. Access to the 30-inch valve of the cast iron pipe should be reestablished and a new control mechanism installed.

5. Retaining walls of the principal spillway should be rehabilitated.

A formal maintenance procedure should be developed and implemented for this facility, which would include an inspection checklist that covers all critical items so they can be periodically inspected and maintained in the highest possible condition. A monitoring procedure should be developed to monitor the structure during periods of exceedingly heavy rainfall. Provisions should also be included to monitor road crossings along the stream and provide road blocks if necessary.

John Boschuk, Jr., P.E.
Pennsylvania Registration 27450E
Woodward-Clyde Consultants

Date 7/30/79



John H. Frederick, Jr., P.E.
Maryland Registration 7301
Woodward-Clyde Consultants

Date 7/30/79

APPROVED BY:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

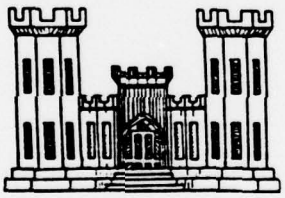
Date 11 Sep 79

DELAWARE RIVER BASIN

LAKE NAOMI DAM
MONROE COUNTY, PENNSYLVANIA

NDS I.D. NO. PA 00777
DER I.D. NO. 45-1

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



Prepared by:

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5120 Butler Pike
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Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
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JULY 1979

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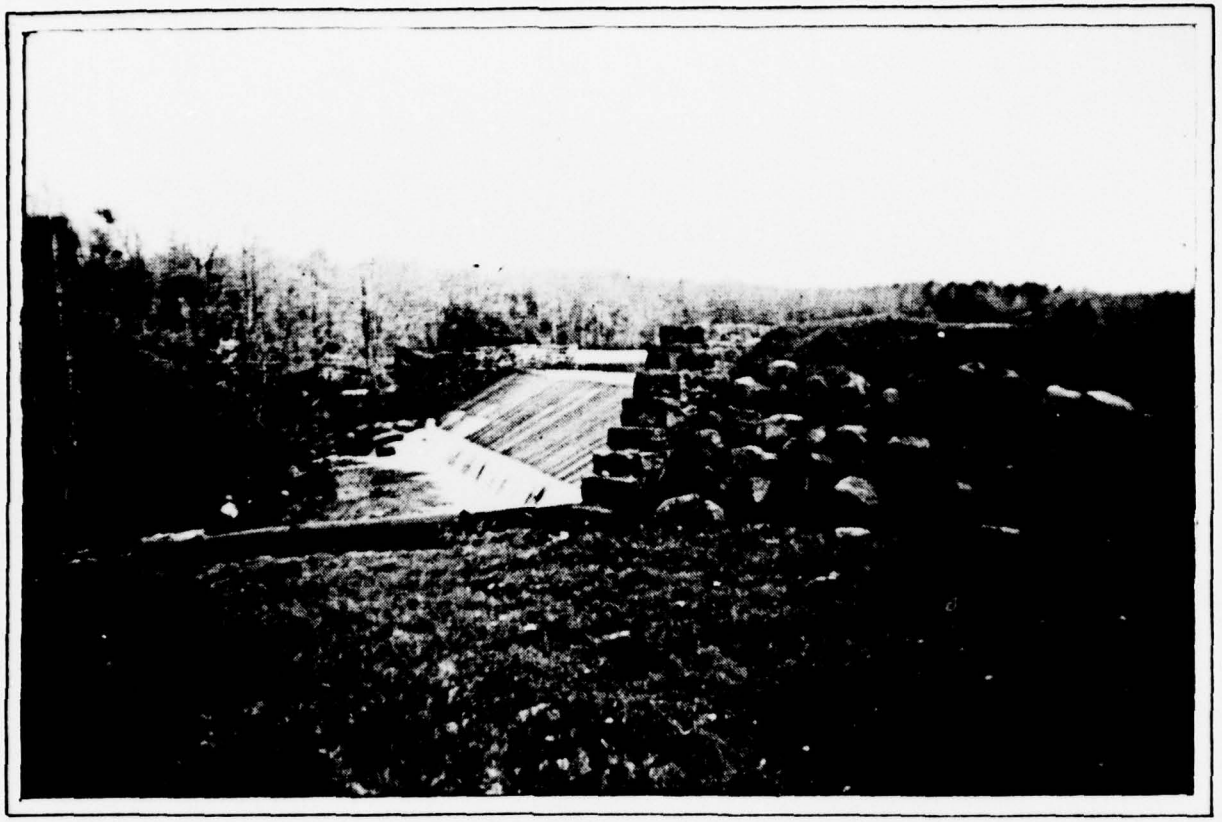

OVERVIEW
LAKE NAOMI DAM, MONROE COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE NAOMI DAM
NATIONAL ID #PA 00777
DER #45-1

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Naomi Dam consists of an embankment section, a main spillway and auxiliary spillway. The embankment section, located along the southern boundary of the reservoir, is approximately 2,700 feet long and averages about six to nine feet high. The main spillway is a rock fill timber crib structure approximately 14 feet high and 100 feet long. Immediately adjacent to the spillway right abutment is a wooden sluice gate, which can be raised to lower the reservoir level. Adjacent to the sluice gate is a 350 foot long auxiliary spillway. The dam and spillways impound a 239 acre reservoir within a 19.47 square mile drainage basin.

There are very few drawings or documents available describing the internal features of the earth dam. Available information only indicates that the earthen embankment was constructed on "sound materials". The upstream slope of the embankment is protected with stone. Since the upstream slope is below water, the inclination could not be measured during the inspection. The average width of the crest is 10 feet. The average downstream slope is 2.5H:1V.

It is reported the main spillway is founded on rock and the upstream slope is protected with clays and gravelly clays to minimize seepage through the structure. Stone masonry walls form the left and right abutments of the main spillway. Under normal conditions, water is discharged over

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NATIONAL DAM INSPECTION PROGRAM
LAKE NAOMI DAM
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There are very few drawings or documents available describing the internal features of the earth dam. Available information only indicates that the earthen embankment was constructed on "sound materials". The upstream slope of the embankment is protected with stone. Since the upstream slope is below water, the inclination could not be measured during the inspection. The average width of the crest is 10 feet. The average downstream slope is 2.5H:1V.

It is reported the main spillway is founded on rock and the upstream slope is protected with clays and gravelly clays to minimize seepage through the structure. Stone masonry walls form the left and right abutments of the main spillway. Under normal conditions, water is discharged over

the main spillway, downstream into Upper Tunkhannock Creek. Excess water can be discharged over the auxiliary spillway, through a wooded zone and eventually into Upper Tunkhannock Creek. The reservoir can be lowered by either opening the 30-inch gate at the upstream end of 30" CIP through the main spillway, or by raising the wooden sluice gate at the right main spillway abutment.

b. Location. Lake Naomi Dam is located on Upper Tunkhannock Creek in the community of Pocono Lake, Tobyhanna Township, Monroe County, Pennsylvania. The dam and reservoir are located on the "Pocono Pines, Pennsylvania" Quadrangle at coordinates N 41° 6.5' W 75° 28.5' near the intersection of Routes 940 and 423. A regional location plan of Lake Naomi Dam and reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" size dam by virtue of its 1,492 acre-foot normal storage capacity.

d. Hazard Classification. A "Significant" hazard classification is assigned consistent with the potential for extensive property damage downstream. However, it is to be noted that hazard potential may be increased at a future time as a result of development along Upper Tunkhannock Creek.

e. Ownership. The dam is owned by the Pocono Pines Corporation. All correspondence should be sent to Mr. Harry J. Schoettle, President, Pocono Pines Corporation, Post Office Box 438, Pocono Pines, Pennsylvania 18350.

f. Purpose of Dam. The reservoir is used for recreation.

g. Design and Construction History. The dam was originally built in 1895 to replace an earlier dam across the creek. The reservoir was used for recreation in the summer and for ice supply during the winter. The 1895 structure was designed by Mr. J. Marshall Young, consulting engineer for the Pocono Pines Ice Company. Since that date, the embankment and principal spillway have remained essentially unchanged, but have been rebuilt several times. The original design included a 30-inch cast iron blow-off pipe embedded through the principal spillway and controlled by a gate and hoist at the upstream end. In addition, at the right abutment was a nine foot wide sluiceway and wooden gates. The auxiliary spillway consisted of a dry, one foot thick stone wall with timber sheeting/earth on the upstream side and large rock on the downstream side.

During the March 1902 storm, the reservoir overflowed the embankment, breaching the structure approximately 100 feet from the spillway. This breach caused the rapid emptying of the reservoir and was a contributing factor to the failure of downstream Pocono Lake Dam, a timber crib dam.

In 1914, the structure was reconditioned, which consisted of replacing the sheeting and some structural crib members of the main spillway. Mr. J. Marshall Young also designed reconstruction. In addition, the wooden sheeting of the auxiliary spillway was replaced with six-inch thick concrete slabs and covered with clay to prevent leakage, with marginal success. In 1919, the State directed additional stone to be placed on the downstream side of the auxiliary spillway wall. The Owner was also directed to construct a concrete wall from the right abutment to natural ground to avoid overtopping at this point. No wall was constructed.

The 1920 State inspection report noted the wall had not been built, and probably was not necessary. Possible movement of the auxiliary spillway was also noted. Again, additional rock fill on the downstream side of the auxiliary spillway was required. The 1921 State report noted the auxiliary spillway slab had been cracked and moved by ice. The reservoir level was down four feet and holes through the slab were visible. The slab had been covered with planking in an attempt to prevent leakage through the slab.

Between 1928 and 1944, only routine maintenance was performed. In 1943, the dam was thoroughly inspected by the State of Pennsylvania, and it was concluded that the dam needed a major restoration. Subsequent to several meetings, permits were issued in April and June, 1944, to restore the dam of the Frank C. Miller estate and to allow the use of flashboards. This work consisted of rebuilding the timber crib main spillway by replacing most of the timbers. The spillway crest was lowered 1.2 feet and flashboards were approved and used. In addition, clay backfill was placed along the upstream side to minimize seepage through the spillway. This reconstruction was designed by Mr. Edward Hess, consulting engineer in Stroudsburg, Pennsylvania.

In 1965, the timber spillway was again repaired and very little repair work has been performed to the main spillway since then. Also, the auxiliary spillway has evolved into a swimming beach by the addition of stone and sand to the upstream/downstream or both sides. Other minor repair work included repointing the main spillway masonry walls and rebuilding the wooden sluice gate and spillway in the early 1970's.

h. Normal Operating Procedures. Under normal conditions, water flows over the main spillway. When the reservoir level is about six inches over the main spillway, excess flow is discharged over the auxiliary spillway to the right of the main spillway. The reservoir may be lowered by raising the wooden sluice gate or by opening the 30-inch gate, which discharges water through a 30-inch cast iron pipe through the main spillway. No minimum downstream flow is required by the State, although leakage through the main and auxiliary spillways provides a minimum downstream flow.

1.3 Pertinent Data.

A summary of pertinent data for Lake Naomi Dam is presented as follows.

a.	Drainage Area (sq miles)	19.47
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood at Site	Unknown
	Maximum Discharge	
	Main	2,380
	Auxiliary	6,780
	Minimum Required Flow	None
c.	Elevation (feet above MSL)	
	Top of Dam	1,758.9
	Main Spillway Crest	1,755.0
	Auxiliary Spillway Crest	1,755.4 to 1,755.7
	Invert of Wood Sluice Gate	5' below spillway crest
	Entrance Invert of 30" CIP	Unknown
	Exit Invert of 30" CIP	1,741± at streambed
	Normal Pool Elevation	1,755
d.	Reservoir (miles)	
	Length at Normal Pool	1.9
	Fetch at Normal Pool	1.0
e.	Storage (acre-feet)	
	Normal Pool	1,492
	Top of Dam	1,790
f.	Reservoir Surface Area (acres)	
	Normal Pool	239
g.	Dam Data (embankment along Route 423)	
	Type	Rolled earth
	Length	2,740 feet
	Height	6 to 9 foot dike

	.Crest Width	10± feet
	Freeboard at Normal Pool	4± feet
	Volume of Fill	27,600 cu yds
	Side Slopes	
	Upstream	Unknown
	Downstream	2.5H:1V
	Cutoff	Unknown
	Grout Curtain	None
h.	Main Spillway	
	Type	Timber crib rockfill structure w/upstream puddled clay cutoff blanket
	Length	100 feet
	Height	14 feet
	Discharge Channel	Natural rock channel
i.	Auxiliary Spillway	
	Type	Earthen overflow section - earth and rock fill protected by concrete slab, timber planking and earth
	Width	350 feet
	Discharge Channel	Wooded valley
j.	Drains	
	Sluice Gate	
	Location	Right abutment of main spillway
	Type	Wood
	Pipe	
	Location	Through main spillway
	Type	30" ID CIP

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Availability. A summary of engineering data is presented in the checklist attached as Appendix A. As noted in this appendix, original design data was limited. Only one drawing pertaining to the original design was available. Other information included several application reports and "Reports Upon the Application of Lake Naomi Dam" pertaining to the repairs performed in 1914, 1920 and 1924. Other data included miscellaneous correspondence and State of Pennsylvania inspection reports. There was no design or construction documentation available.

b. Design Features. The principal design features are illustrated on the plan, profile and cross-section plates enclosed in Appendix E. Information was obtained from the available drawing and from measurements taken during the recent inspection. A summary of the pertinent features is included in Section 1.3.

2.2 Construction.

Available data concerning construction and repairs performed to this dam are described in Section 1.2, paragraph g. It is understood that the original designer was Mr. J. Marshall Young and that subsequent repair work was performed with very little engineering consultation. However, in 1944, Mr. Edward Hess, consulting engineer of Stroudsburg, Pennsylvania, did perform some engineering evaluations as to the type, quantity and extent of repair that was necessary for rehabilitation of the dam.

2.3 Operational Data.

No water level or rainfall measurements are maintained by the Owner.

2.4 Evaluation.

a. Availability. Information presented herein was obtained from records located in the Department of Environmental Resources' files in Harrisburg, Pennsylvania, or supplemented by conversations with the Owner's representative

during the inspection. Hydrologic and hydraulic data and calculations prepared for this report were obtained from the files and the field inspection.

b. Adequacy. Available data included in State files and presented in this report are not considered adequate to evaluate all the engineering aspects of this dam and its appurtenant structures.

c. Validity. There is no reason to question the validity of the limited available data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. Observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix B, and are summarized and evaluated in the following sections. In general, the appearance of the earthen embankment and main spillway are considered to be in good condition. The auxiliary spillway is considered to be in poor condition.

b. Dam. Vertical alignment along the crest of the embankment (dike) along Route 423 was checked and found to be reasonably uniform. The embankment appears to be in reasonably good condition and there were no signs of significant seepage. Horizontal alignments were good and the upstream riprap also appears to be in good condition. There were no surface cracks observed, and junctions between the embankment and abutment were in good condition. Although there was no seepage noted along the main embankment section, which parallels Route 423, seepage was observed downstream of the auxiliary spillway. Leakage locations are shown on sheet 5a, Appendix B.

c. Appurtenant Structures.

1. Main Spillway. The rock filled timber crib ungated spillway is considered to be in good condition, but there is significant seepage noted through the structure despite the reported puddled clay upstream impervious fill. It is noted this spillway was repaired many times since it was originally built in 1895, most recently in the early 1970's. The retaining walls of the spillway are considered in reasonably good condition, with some deterioration noted along the joints of the walls. The discharge channel is considered to be in good condition.

2. Outlet Works. There is a 30-inch cast iron pipe through the main spillway. Only a portion of the pipe which extends beyond the main spillway could be inspected and was found to be in good condition. The valve was not exercised as proper equipment was not available. Water passing through the pipe was reported by the Owner to be leakage through the upstream gate.

The second outlet structure consists of a wooden gated spillway considered in good condition. This structure

is located as shown on Plate 2, to the right of the main spillway adjacent to the auxiliary spillway. Some slight leakage was noted at the lower corners of the gate. It is noted that a backhoe or bulldozer is required to raise this gate. The discharge area beyond the gated spillway is considered to be in fair condition. Erosion is considered probable if significant quantity of discharge passes through the gate.

3. Auxiliary Spillway. The auxiliary spillway, located to the right of the wooden sluice gate and shown on Plate 2, is currently being used as a beach. The known construction and repair history is reported in Section 1. Visual inspection revealed a fine gravelly sand beach, 31 to 49 feet wide. The downstream slope is composed of rock, broken concrete and some brush. Significant quantities of seepage were flowing through the stone and concrete. The crest surface is not resistant to erosion and it is believed that significant erosion and failure would occur as a result of large flows through the auxiliary spillway.

d. Reservoir. The reservoir area is flat, stable and well vegetated with trees and brush to the water's edge. There is no evidence of significant siltation, bank erosion, slope instability or other features that would significantly affect the flood storage capacity of the reservoir.

e. Downstream Channel. About 300 feet downstream of the dam is PA Route 423. The channel from the main spillway between the dam and bridge has a rocky bottom and stable side slopes. Flow from the auxiliary spillway flows through woods before entering the channel or flowing over the highway. The highway has frequently been flooded by auxiliary spillway flow. Downstream of the bridge, Upper Tunkhannock Creek flows through a narrow, wooded valley with an approximate gradient of 0.01. About 1.9 miles below the dam, Upper Tunkhannock Creek enters Pocono Lake Reservoir.

3.2 Evaluation.

In summary, visual inspection of the dam and appurtenant structures disclosed no evidence of incipient failure. Results of the visual inspection indicate the timber crib structure is in good condition and the auxiliary spillway is in poor condition.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Normal procedures do not require a dam tender. Under normal conditions, all water is discharged over the timber crib main spillway. In the event of large flows, excess water is discharged over the auxiliary spillway. The reservoir may be lowered either through the wooden sluiceway or through the cast iron pipe.

4.2 Maintenance of the Dam.

There is very little evidence of routine maintenance of this structure.

4.3 Maintenance of Operating Facilities.

Similar to dam maintenance, there is very little evidence that operating facilities have been maintained in good condition. Specifically, the access bridge to the 30-inch discharge pipe, as shown on Photograph 1, is in poor condition. The auxiliary spillway, shown on Photographs 12 through 14, is also in poor condition, and significant quantities of leakage, as shown on Photographs 15 and 16, are present.

4.4 Warning Systems In Effect.

There are no formal warning systems or procedures established to be followed during periods of exceedingly heavy rainfall.

4.5 Evaluation.

There are no written operational, maintenance or warning procedures. If the dam were to fail, extensive property damage and failure of one small downstream dam is likely to occur. In the event of catastrophic failure, a large inflow of water would be discharged into Pocono Dam Reservoir. An inspection of the stream channel between Lake Naomi Dam and the headwaters of Pocono Reservoir revealed there are no residences which are likely to be affected by the failure of Lake Naomi Dam. If the embankment along the south edge of the reservoir were to fail, water would flow parallel to State Route 423 before entering the natural stream.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design/Evaluation Data. The only information available is the State's evaluation of the spillway as rebuilt in 1944. Hydrologic and hydraulic evaluations made as a part of this investigation are contained in Appendix C.

The watershed is almost completely wooded, having a total area of 19.47 square miles. There are four upstream dams. Stillwater Lake, DER No. 45-40, is 2.75 miles upstream of Lake Naomi Dam on Upper Tunkhannock Creek. It is about eight feet high, with a normal storage of 1,335 acre-feet. Lynchwood Lake, DER No. 45-38, is about 2.75 miles upstream of Stillwater Dam on Hawkey Run. It is about 20 feet high, with a normal storage of 285 acre-feet. Summit Lake, DER No. 45-39, is about 1.89 miles upstream of Stillwater Lake Dam on Red Run. It is eight feet high, with a normal storage of less than 1.5 acre-feet. Summit Lake Dam, DER No. 45-19, is about 1,000 feet upstream of Summit Lake on Red Run. It is 10 feet high with a normal storage of 215 acre-feet. The storage of Summit Lake and Summit Lake Dam have been combined and are assumed to act as a single structure. Scattered throughout the watershed, and especially at the upper end of each reservoir, are swamp/marshy areas. The total of these areas is estimated visually from USGS maps to be about one square mile. Residential development is estimated to be 25 to 35 percent of the watershed. Residential development is expected to continue within the watershed.

In 1944, the State evaluated the capacity of the spillways, 2,950 cfs for the main spillway without flashboards with a head of 4.4 feet. With flashboards in place and the same reservoir level, the discharge was 2,060 cfs. The flashboards were designed to fail when the water level was 1.6 feet above their crest. The auxiliary spillway capacity was estimated to be 6,180 cfs at the same reservoir level.

In accordance with criteria established by Federal (OCE) Guidelines, the recommended spillway design flood for this "Intermediate" size dam and "Significant" hazard classification is 0.5 to 1.0 PMF (Probable Maximum Flood).

b. Experience Data. No reservoir level records or rainfall records are maintained by the Owner. However, there are three reporting (to the National Weather Service) rain gaging stations within a 10-mile radius of the dam. It was

reported at the time of inspection that the depth of water over the auxiliary spillway during Hurricane Diane, August 1955, was two feet. Average rainfall over the watershed was 5.72 inches for the maximum six hours increment and 9.62 inches for 48 hours. These rainfalls represent 24 to 32 percent of the PMF; see Appendix C.

c. Visual Observations. On the date of inspection, there were no conditions observed that would indicate a reduced spillway capacity. A condition observed that may indicate a reduced flood retention capability during an extreme event is the condition of the auxiliary spillway. An evaluation based on the visual inspection indicates that the spillway is not resistant to erosion and would probably fail as a result of overtopping for a significant period of time. State files indicate it is constructed of rock fill protected by a concrete slab with earth over the slab, and rock downstream of the rock fill for stability. Subsequent State inspection reports indicate the slab had been damaged by ice. Repairs had been made by the Owner. However, a realistic determination of the stability of the auxiliary spillway section is impossible to make by a review of the records and a visual inspection alone.

d. Overtopping Potential. Overtopping potential of this dam was estimated using "HEC-1, Dam Safety Version", computer program. A brief description of the program is included in Appendix C. Calculations indicate the maximum main spillway capacity is about 2,380 cfs when the reservoir level is at minimum embankment crest elevation. Auxiliary spillway capacity discharge would be about 6,780 cfs. The HEC-1 computed peak PMF inflow is 22,575 cfs assuming no upstream dam failures. Assuming no failures of upstream structures or of the auxiliary spillway, the spillways could pass 0.62 PMF without overtopping the embankment.

Visual inspection of Lynchwood Lake Dam and Pocono Summit Dam indicated these dams are subject to failure as a result of overtopping. Visual inspection and evaluation of Stillwater Lake Dam indicated it is not likely to fail as a result of overtopping. The next computer run assumed failure of those two upstream dams, resulting in a peak PMF inflow to Lake Naomi of 23,350 cfs. Lake Naomi spillways could pass 0.57 PMF assuming upstream dam failures. The final computer run also assumed failure of the auxiliary spillway section of Lake Naomi Dam if the depth of flow was greater than two feet. Lake Naomi Dam auxiliary spillway was estimated to fail by overtopping the auxiliary spillway by an 0.31 PMF event.

e. Spillway Adequacy. The spillway system for this dam is rated as "Inadequate" but not "Seriously Inadequate" as the structure has a "Significant" hazard potential. Also, although the dam is assessed to fail as a result of overtopping the auxiliary spillway by the 0.5 PMF event, the peak discharge and downstream stage are not expected to increase significantly. Similarly, failure of upstream dams and Lake Naomi Dam is expected to have little or no effect on downstream Pocono Lake Dam under the assumed breach criteria.

f. Downstream Conditions. Lake Naomi Dam is located 3.9 miles upstream of Pocono Lake Dam. The valley between is completely wooded with several rock check dams between Pocono Lake and Lake Naomi Dam. Although significant property damage is expected from failure as a result of the PMF event, no homes are expected to be affected by large flows alone. About 300 feet downstream of the dam, Upper Tunkhannock Creek passes under PA State Route 423, under a local road about 4,200 feet farther downstream and under PA State Route 940 about 1,500 feet farther downstream.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations indicated no immediate embankment stability problem. Visual inspection of the main spillway revealed leakage through the timber crib structure, a normal occurrence for this type structure. The exposed wooden sheathing of the spillway is assessed to be in reasonably good condition. Some deterioration of the mortar on the masonry retaining walls was noted.

The auxiliary spillway is considered to be in poor condition. The surficial materials are not erosion resistant. Available records also indicate the internal materials may have a marginal resistance to erosion. The condition of the spillway can readily be seen in Photographs 13 and 14. At the base of the spillway and beyond, seepage as noted in Photographs 15 and 16 is prevalent. In the event of large flows through this spillway, severe erosion and probable spillway failure are likely.

The wooden sluice gate is assessed to be in reasonably good condition and leakage noted at the bottom of the gate is expected for this structure type. The overall condition of the 30-inch cast iron pipe through the main spillway could not be assessed as the sluice gate was underwater, the valve was unavailable and most of the pipe was buried within the spillway. The end section of the pipe is assessed to be in good condition.

b. Design and Construction Data. There was no design data available for the original structure constructed in 1895. Since then, major repair work has been performed in 1914, 1920, 1924, 1928, 1965, and most recently in the early 1970's. Most of this work was associated with rebuilding the main and auxiliary spillways. There is very little reconstruction documentation pertaining to types of materials, foundation preparation procedures, and overall performance of the work. Subsequently, very little information exists which can be evaluated.

c. Operating Procedures. No operating procedures currently exist.

d. Post-Construction Changes. Since completion of the dam in 1895, the principal and auxiliary spillways were repaired on at least six occasions. A description of this work is presented in Section 1.

e. Embankment Stability. There are no embankment stability evaluations located in the files. However, the embankment appears to be a very minor portion of the structure as it is merely a small dike which helps to contain the reservoir. The major impounding structures consist of the main and auxiliary spillways. The stability of the timber crib system could only be evaluated based on qualitative assessment of the structure's performance since 1895. It is obvious, based on its long period of satisfactory performance, that the main spillway is stable. The auxiliary spillway appears to be stable under normal conditions but, in the event flows pass through this spillway, severe erosion and loss would be expected.

f. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static conditions, it can be assumed safe for any expected earthquake conditions. Since the static factor of safety for the dam is unknown, a seismic stability evaluation could not be made.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. On the basis of visual inspection, the dam and its appurtenant structures are considered to be in fair condition. There are no engineering or construction data other than information presented in Section 1 of this report. The embankment portion of the structure appears to be stable, as well as the main spillway. However, the resistance to erosion of the auxiliary spillway during passage of flows is considered to be unsatisfactory. Serviceability of this spillway is considered to be marginal, at best, and it is judged that rehabilitation of the auxiliary spillway is necessary. The spillway is rated as "Inadequate" as discussed in Section 5.

b. Adequacy of Information. There was insufficient engineering and post-construction rehabilitation documentation to adequately evaluate the stability of the dam and its appurtenant facilities. Specifically, there were no plans or specifications prepared. There was no evidence of detailed plans or engineering evaluations of the serviceability of the auxiliary spillway.

c. Urgency. It is concluded that recommendations considered critical in Section 7.2 be implemented immediately. All other items should be implemented as soon as practical.

d. Necessity for Additional Studies. It is judged that additional investigations pertaining to serviceability of the auxiliary spillway be performed. All recommendations are described in Section 7.2.

7.2 Remedial Measures.

a. Facilities. The following remedial work is considered critical and should be performed immediately under the direction of a registered professional engineer experienced in dam design.

1. A geotechnical investigation of the auxiliary spillway should be performed.

2. Pending the results of Recommendation 1, the spillway system should be reconstructed to meet current hydrologic/hydraulic criteria as determined from a detailed hydrologic/hydraulic analysis.

3. Trees and other vegetation downstream of the auxiliary spillway should be removed to improve hydraulic conditions.

The following items are considered important and should be performed as soon as practical.

1. Access to the 30-inch valve of the cast iron pipe should be reestablished and a new control mechanism installed.

2. Retaining walls of the principal spillway should be rehabilitated/repointed.

b. Operation and Maintenance Procedures. A formal maintenance procedure should be developed and implemented for this facility. The Owner should develop an inspection checklist for the maintenance procedure to insure that all critical items are periodically inspected and maintained.

A warning procedure should be developed to include provisions for monitoring the structure during periods of exceedingly heavy rainfall. The procedure should include a method of warning residents around Pocono Lake Reservoir that high flows are expected into the reservoir which could result in abnormally high lake levels. Provisions should also be included to monitor road crossings along the stream and provide roadblocks, as necessary.

APPENDIX

A

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Lake Naomi Dam*

ID # *PA 00777*

ITEM	REMARKS
AS-BUILT DRAWINGS	*Four construction drawings dated 1944 were located in DER files.*
REGIONAL VICINITY MAP	*See Plate 1, Appendix E.*
CONSTRUCTION HISTORY	*Available data is presented in Section 1 of the report.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*See Appendix E.*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*See Appendix C.*
RAINFALL/RESERVOIR RECORDS	*No records maintained.*

ITEM	REMARKS
DESIGN REPORTS	*None available in DER files.*
GEOLOGY REPORTS	*None available in DER files. Geologic data is presented in Appendix F of report.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*None available.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*No data available.*
POST-CONSTRUCTION SURVEYS OF DAM	*No data available.*
BORROW SOURCES	*Unknown. Probably from reservoir area.*

ITEM	REMARKS
MONITORING SYSTEMS	*None*
MODIFICATIONS	*See Section 1 of report.*
HIGH POOL RECORDS	*No records maintained.*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*Unknown.*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*See Appendix E.*
MISCELLANEOUS	1. *Application Permits* 2. *Several reports on the condition of the dam prepared by the State of Pennsylvania.* 3. *Several photographs.* 4. *Miscellaneous letters, memos and other data.* 5. *State Inspection reports.*

APPENDIX

B

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Lake Naomi Dam* County *Monroe* State *Pennsylvania* National ID # *PA 00777*

Type of Dam *Timber cribbing and Earth* Hazard Category *Significant*

Date(s) Inspection *10 May '79* Weather *Partly cloudy, warm* Temperature *80's*

Pool Elevation at Time of Inspection *1775.2* M.S.L. Tailwater at Time of Inspection *1739±* M.S.L.

Inspection Personnel:

John Boschuk, Jr. (Geotechnical) *Raymond Lambert (Geologist)* *John H. Frederick (Geotechnical)*

Mary F. Beck (Hydrologist) *Vincent McKeever (Hydrologist)*

John Boschuk, Jr. Recorder

Remarks:

Mr. Ray Hansen, representative of Lake Naomi Associates, was on site and provided assistance to the inspection team.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	*N/A*	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	*N/A*	
DRAINS	*N/A*	
WATER PASSAGES	*N/A*	
FOUNDATION	*N/A*	

CONCRETE/MASONRY DAMS

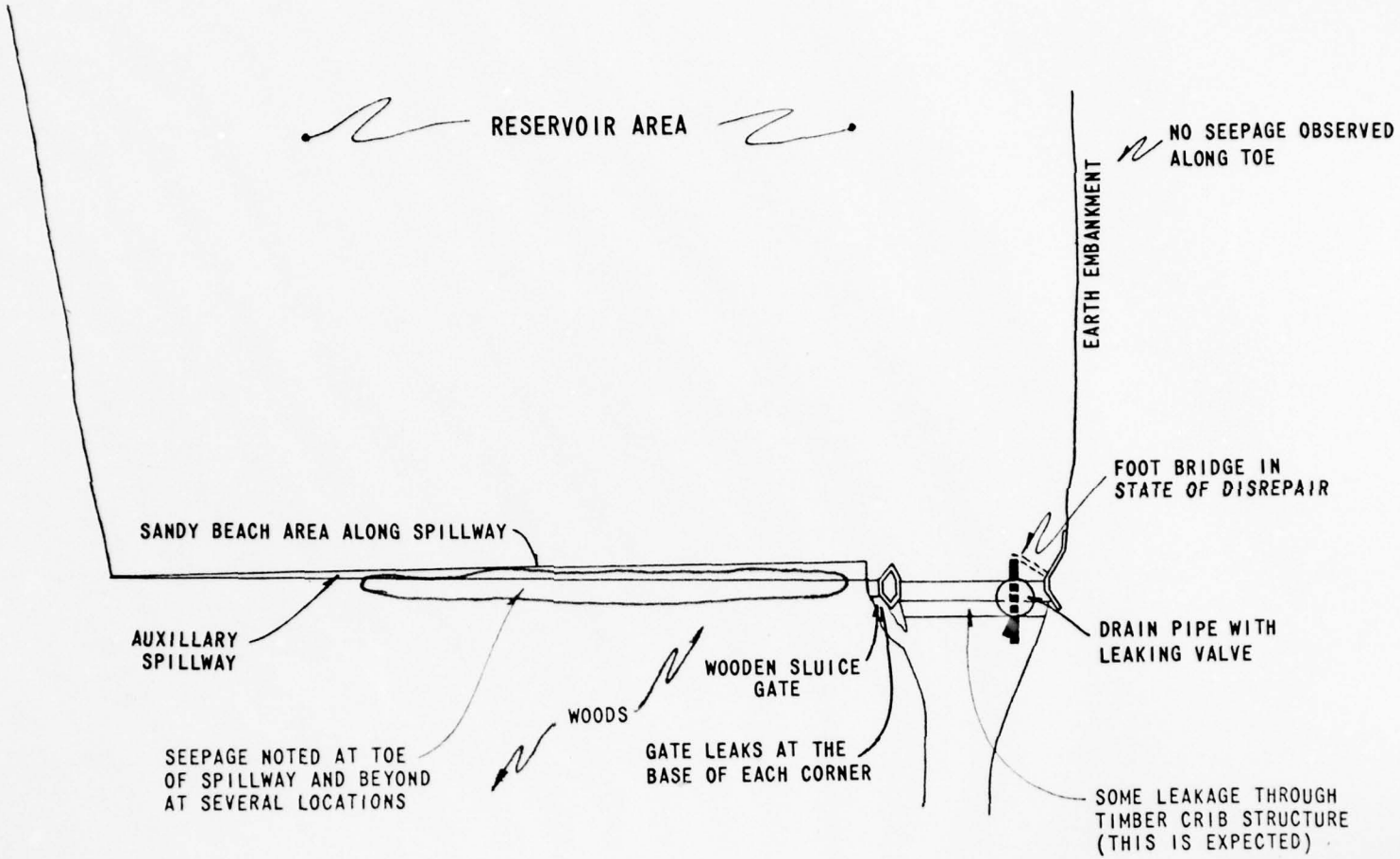
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	*N/A*	
STRUCTURAL CRACKING	*N/A*	
VERTICAL AND HORIZONTAL ALIGNMENT	*N/A*	
MONOLITH JOINTS	*N/A*	
CONSTRUCTION JOINTS	*N/A*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
EMBANKMENT (GENERAL DISCUSSION)	*The embankment appears to be in reasonably good condition and there were no signs of significant seepage.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*Good*	
RIPRAP FAILURES	*None*	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*Good condition.*	
ANY NOTICEABLE SEEPAGE	*See Sheet 5a for locations of leakage.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None*	



FIELD OBSERVATION PLAN
LAKE NAOMI DAM

SHEET 5A OF 11

PIPED

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*None*	
INTAKE STRUCTURE	*Underwater and could not be inspected. Valve was not exercised.*	
OUTLET STRUCTURE	*Cast iron pipe is in good condition but some leakage was noted through the gate.*	
OUTLET CHANNEL	*Rock lined channel in good condition.*	

TIMBER CRIB
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
WOODEN WEIR AND CHUTE	*Good condition. The structure was rebuilt several years ago, by the owners, without drawings, etc. Seepage was noted through the chute but is expected for this type of structure.*	
DISCHARGE CHANNEL	*Rock channel is in good condition.*	
RETAINING WALLS	*Fair condition with some deterioration of the downstream walls. See photographs. Some settlement was noted adjacent to the wall as noted on the photographs.*	

AUXILLARY
UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
EARTH WEIR	*Poor condition. Currently used as a beach.*	
APPROACH CHANNEL	*None*	
DISCHARGE CHANNEL	*Direct discharge over miscellanous fill into wooded discharge channel. Hydraulic characteristic of entire auxillary spillway systems are poor.*	
BRIDGE AND PIERS	*None*	

WOODEN
GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SUPPORT STRUCTURE	*Good condition.*	
WOOD GATE	*Good condition with slight leakage at lower corners of the gate. Backhoe/bulldozer are required to open this gate. See the photographs, Appendix D.*	
DISCHARGE CHANNEL	*Fair condition. Erosion is probable when the gate is opened.*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*Reservoir area is flat, stable, well vegetated with trees and brush to water's edge.*	
SEDIMENTATION	*Sedimentation is minimal with no effect on flood water storage.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The channel flows through the woods. The channel has rock bed with stable side slopes.*	
SLOPES	*The valley gradient is about 0.01.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*About 1.9 miles below the dam, Upper Tunkhannock Creek enters Pocono Lake reservoir.*	

APPENDIX

C

LAKE NAOMI
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *95% wooded, 25 to 35% residential, 4 upstream dams.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *1755. feet (1192 Acre-Feet)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *1758.9 feet (1790 Acre-Feet)*

ELEVATION MAXIMUM DESIGN POOL: --------

ELEVATION TOP DAM: *1758. 9 feet.*

SPILLWAY/AUXILARY SPILLWAY

a. Elevation *1755 feet/1755.4 feet.*

b. Type *Timber cribbing with sheeting/earth overflow section.*

c. Width *100 feet/350 feet.*

d. Length *Not applicable/Not applicable.*

e. Location Spillover *Right abutment/Right of spillway*

f. Number and Type of Gates *None.*

OUTLET WORKS:

a. Type *Wood sluice gate and C.I.P.*

b. Location *Right side of spillway and beneath spillway.*

c. Entrance inverts ---

d. Exit inverts ---

e. Emergency draindown facilities ---

HYDROMETEOROLOGICAL GAGES:

a. Type *None maintained by owner, two Weather Service Stations within the watershed.*

b. Location *Not applicable.*

c. Records *National Weather Service.*

MAXIMUM NON-DAMAGING DISCHARGE: *Not determined.*

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

BY MFB DATE 5/31/79 SUBJECT Lake Naomi Dam Hydrology / Hydraulics SHEET 3 OF 27

CD. BY DATE JOB No.

Classification (Ref. - Recommended Guidelines for Safety Inspection of Dams)

1. The hazard classification is "Intermediate" as failure would result in significant property damage and possible loss of life.

2. The size classification is "Intermediate" based on its 1492 Ac-Ft normal storage capacity.

3. The spillway design flood, based on size and hazard classification, is determined to be the Probable Maximum Flood (PMF).

Hydrology and Hydraulic Analysis

1. Spillway capacity was evaluated by the State in 1944.

$Q = C L H^{3/2}$

Main spillway

$L = 99.6$ ft

w/o flashboards	w/ flashboards
$C = 3.2$	$C = 3.3$
$H = 4.4$ ft	$H = 3.4$ ft
$Q = 2950$ cfs	$Q = 2060$ cfs

Emergency spillway

$L = 350$ ft

$C = 3.4$

$H = 3$ ft.

$Q = 6180$ cfs

2. Evaluation of structure was by use of the computer program. Computer input data as follows:

There are four upstream dams. The following information is from USGS maps or PA Dept. of Forests & Waters Bulletin No. 5.

Stillwater Lake, 45-40, 2.75 miles upstream of Lake Naami Dam on Upper Tunkhannock Creek. 8 ft. high; 1335 Ac-Ft. normal storage; 13.16 sq. mile drainage area.

Lynchwood Lake, 45-38, 2.91 miles upstream of Stillwater Dam on Hawkey Run. 20 ft. high, 285 Ac-Ft normal storage; 3.39 sq. mile drainage area.

Summit Lake, 45-39, 1.89 miles upstream of Stillwater Dam on Red Run. 8 ft high; less than 1.5 Ac-Ft normal storage; 3.21 sq. miles drainage area.

Summit Lake Dam, 45-19, 1000 feet upstream of Summit Lake on Red Run. 10 ft high; 215 Ac-Ft normal storage.

For this investigation the above two dams shall be treated as one, Pocono Summit Dam, 8 ft high, 215 Ac-Ft normal storage, 89 Ac reservoir surface area.

Inflow Hydrographs

drainage areas, determined from USGS maps, are shown above.

rainfall, shown on sheets 10, 12, 14, 16 & 17, Ref. Hydrometeorological Report No. 33

Snyder's hydrograph parameters, tp & Cp

$t_p = C_t (L \cdot L_{ca})^{0.3}$

$C_t = 2.1$ } Information received from Corps of
$C_p = 0.45$ } Engineers; Baltimore, for Zone 2

L & Lca determined from USGS map

sub-area	L (miles)	Lca (miles)	tp
Lynchwood	2.46	0.95	2.71
Pocono Summit	4.28	1.61	3.75
Stillwater	3.03	1.14	3.04
Lake Naomi North	4.64	2.75	4.51
Lake Naomi South	4.36	2.65	4.38

(the uncontrolled watershed draining into Lake Naomi was further divided for ease of calculation area, L & Lca)

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CKD. BY DATE JOB No.

Reservoir Routing

elevation - storage. Normal storage of upstream dam shown above, flood storage estimated from USGS map. Total storage for each dam shown on SUMMARY OF DAM SAFETY ANALYSIS sheets.

elevation - discharge. Discharges were calculated by the computer using $Q = C L H^{3/2}$ and information given below. Any auxiliary spillway discharge and/or flow over the top was calculated by the program assuming critical depth.

Lynchwood Lake, Photo 19.
C = 2.6 Ref Table 5-3, King & Brater, Handbook of Hydraulics
L = 24ft field measured
auxiliary spillway, 0.5 ft higher, 220 ft long

Pocono Summit, Photo 18
C = 3.3 Ref. Table 5-3
L = 20ft field checked

Stillwater, Photo 17
C = 2.7 Ref. -Table 5-5
L = 60 ft. field checked

Lake Naomi, shown on sheet 18.
L = 100 ft. field checked
discharge estimated using critical depth

$d_c = \frac{2}{3} H \quad V_c^2/2g = \frac{1}{3} H \quad Q = V_c d_c 100$

$H = 3.9 \quad d_c = 2.6 \quad V_c^2/2g = 1.3 \quad Q = 9.149 \cdot 2.6 \cdot 100 = 2379 cfs$

auxiliary spillway discharge is calculated by computer as part of top of dam.

A schematic of the computer program operations is included as sheet 8. Channel routing of Lynchwood and Pocono Summit outflow to the upper end of Stillwater has been neglected. It is estimated that channel routing would have little effect.

Lynchwood Dam is assumed to fail if the reservoir level reaches the top of the dam, 1883 ft. It is estimated a trapazodial breach, 150 ft. wide, will take 4 hours to reach elev. 1871.

Pocono Summit is assumed to fail if the embankment is overtopped by one foot for more than 4 hours. It is estimated a trapazodial breach, 200 ft. wide, will take 10 hours to reach elev. 1821, 4 ft below spillway elevation.

Stillwater Lake, based on visual inspection, this dam is assessed not to fail.

Lake Naomi Dam, as discussed in the text, the auxiliary spillway appears to have a limited resistance to erosion and failure as a result of flow through the spillway. The auxiliary spillway is assessed to fail if the depth of flow is 2 ft. It is estimated a trapazoidal breach, 150 ft wide, will take 10 hours to reach elev. 1751.4.

A frequent storm of record for this area is Hurricane Diane, Aug 1955. Hourly precipitation readings are published by the Weather Service for Mt. Pocono and Blakeslee stations. By inspection of the rainfall map of Diane, it is estimated the areal rainfall for Lake Naomi watershed is equal to the average of the reported point rainfalls.

	Mt. Pocono	Blakeslee	Ave.	PMP*	% PMP
6 hr	6.97"	4.65"	5.72"	22.97"	24%
12 hr	9.19"	6.89"	8.04"	25.64"	31%
24 hr	9.82"	7.16"	8.49"	27.88"	30%
48 hr	10.47"	8.76"	9.62"	29.88"	32%

Overtopping Potential - as shown on sheet 22, the spillways pass 0.62 PMF without overtopping the embankment, however, the auxiliary spillway is assessed to fail with 0.34 PMF (sheet 27).

* Hydrometerological Report No. 33

BY MFB DATE 6/14/7 SUBJECT Lake Naomi Dam SHEET 7 OF 27

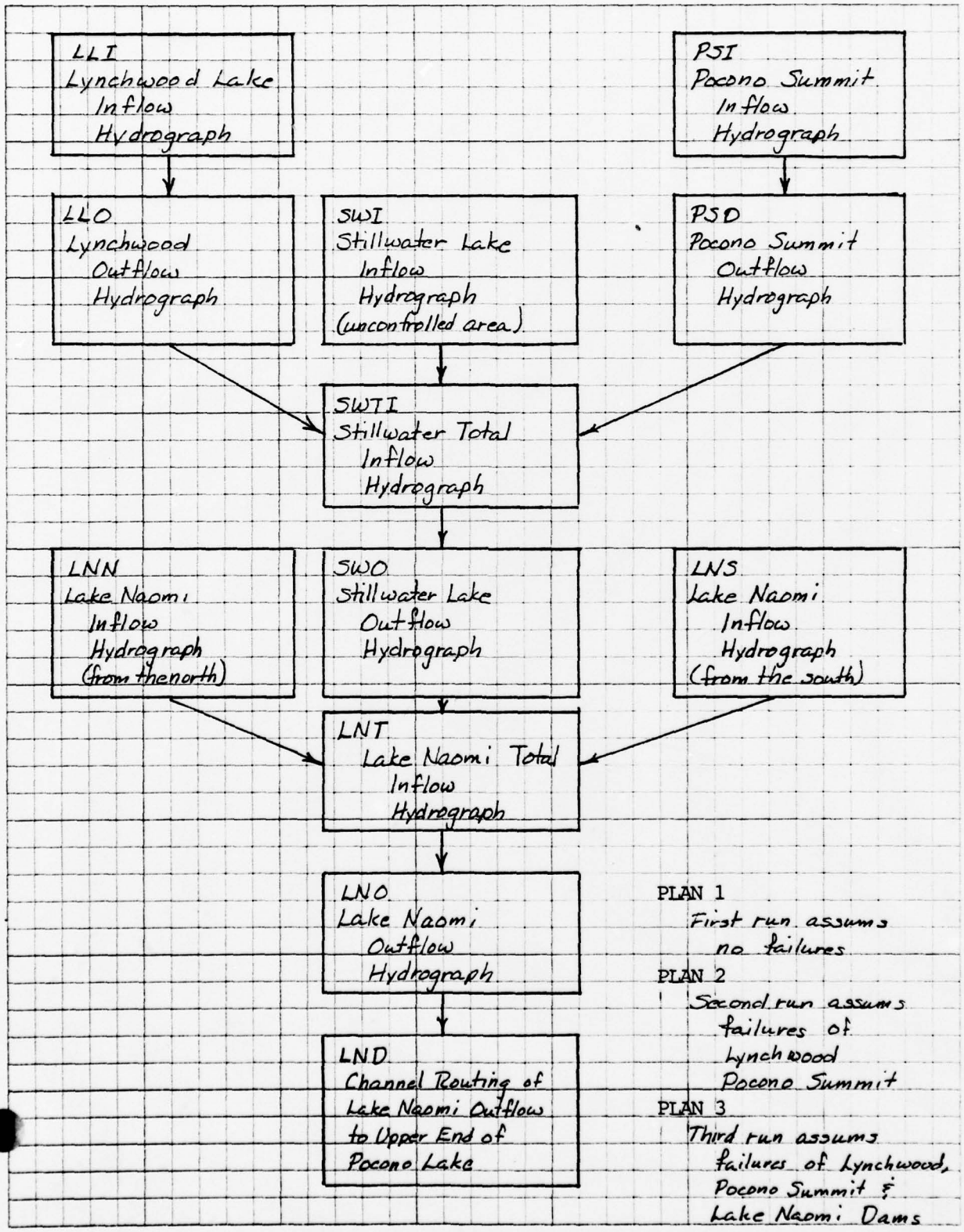
CD. BY DATE Hydrology / Hydraulics JOB No.

Spillway Adequacy - Ref - ETL No. 1110-2-234, 10 May 1978
The spillway is rated as "Inadaquate" but not "Seriously Inadequate" based on its "Significant" hazard classification.

Although the auxiliary spillway is assessed to fail at the 0.5 PMF, the increase in peak discharge or downstream stage is not expected to be Significantly greater under the assumed failure criteria. Failure is also not expected to have a significant effect on downstream Pocono Dam.

BY MEB DATE 5/31/79 SUBJECT Lake Naomi Dam Hydrology / Hydraulics SHEET 8 OF 27

KD. BY DATE JOB No.



PLAN 1
First run assums no failures

PLAN 2
Second run assums failures of Lynchwood Pocono Summit

PLAN 3
Third run assums failures of Lynchwood, Pocono Summit & Lake Naomi Dams

HFB 6/4/79 Lake Naomi Hydrology/Hydraulics SH 9 OF 27

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	LLI
ROUTE HYDROGRAPH TO	LLO
RUNOFF HYDROGRAPH AT	PSI
ROUTE HYDROGRAPH TO	PSO
RUNOFF HYDROGRAPH AT	SWI
COMBINE 3 HYDROGRAPHS AT	SWTI
ROUTE HYDROGRAPH TO	SWO
RUNOFF HYDROGRAPH AT	LNS
RUNOFF HYDROGRAPH AT	LNN
COMBINE 3 HYDROGRAPHS AT	LNT
ROUTE HYDROGRAPH TO	LND
ROUTE HYDROGRAPH TO	LND
END OF NETWORK	

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 79/06/01.
TIME= 08.16.40.

LAKE NAOMI DAM
NAT ID NO. PA 00777 DER NO. 45-1
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
200	0	30	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 6 LRTIO= 1

RTIOS= .10 .30 .50 .70 .90 1.00

MFB 6/4/79 Lake Naomi Hydrology/Hydraulics SH. 10 OF 27

SUB-AREA RUNOFF COMPUTATION

LYNCHWOOD LAKE INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LLI	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	3.39	0.00	19.46	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	103.00	115.00	125.00	134.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .822

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 2.75 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 50 END-OF-PERIOD ORDINATES, LAG= 2.76 HOURS, CP= .45 VOL= 1.00

24.	88.	178.	269.	335.	356.	335.	299.	267.	238.
213.	190.	170.	151.	135.	121.	108.	96.	86.	77.
68.	61.	55.	49.	43.	39.	35.	31.	28.	25.
22.	20.	18.	16.	14.	12.	11.	10.	9.	8.
7.	6.	6.	5.	4.	4.	4.	3.	3.	3.

END-OF-PERIOD FLOW

0 MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
SUM			24.57	22.18	2.39	98512.							
			(624.)	(563.)	(61.)	(2789.55)							

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HYDROGRAPH ROUTING

LYNCHWOOD LAKE OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LLO	1	0	0	0	0	1	0	

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1881.	0

CAPACITY=	0.	285.	800.
ELEVATION=	1861.	1881.	1890.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1881.0	24.0	2.6	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1883.0	0.0	0.0	0.

CREST LENGTH AT OR BELOW ELEVATION	220. 1881.5	370. 1883.0	1200. 1884.0

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SUB-AREA RUNOFF COMPUTATION

POCONO SUMMIT INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
PSI	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	3.21	0.00	19.46	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	103.00	115.00	125.00	134.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .822

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 3.75 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 68 END-OF-PERIOD ORDINATES, LAG= 3.75 HOURS, CP= .45 VOL= 1.00

11.	40.	81.	129.	177.	217.	243.	251.	240.	221.
203.	187.	172.	158.	145.	134.	123.	113.	104.	96.
88.	81.	74.	68.	63.	58.	53.	49.	45.	41.
38.	35.	32.	30.	27.	25.	23.	21.	20.	18.
17.	15.	14.	13.	12.	11.	10.	9.	8.	8.
7.	7.	6.	6.	5.	5.	4.	4.	4.	3.
3.	3.	3.	2.	2.	2.	2.	2.		

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
SUM			24.57	22.18	2.39	92382.							
			(624.)	(563.)	(61.)	(2615.97)							

MEB 6/4/79

Lake Naomi
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HYDROGRAPH ROUTING

POCONO SUMMIT OUTFLOW HYDROGRAPH

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	PSO	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1825.	0

CAPACITY=	0.	215.	1265.
ELEVATION=	1817.	1825.	1832.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1825.0	20.0	3.3	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
1826.5	0.0	0.0	0.

CREST LENGTH AT OR BELOW ELEVATION	500.	1000.
	1826.5	1830.0

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                         SUB-AREA RUNOFF COMPUTATION

         STILLWATER LAKE INFLOW HYDROGRAPH

                ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                  SWI       0       0       0       0       0       1       0       0

                                  HYDROGRAPH DATA
         IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
             1       1    6.56    0.00   19.46    0.00   0.000       0       1       0

                                    PRECIP DATA
                   SPFE     PMS      R6     R12     R24     R48     R72     R96
                   0.00   22.30  103.00  115.00  125.00  134.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS  .822

                                     LOSS DATA
        LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
            0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .05    0.00    0.00

                                UNIT HYDROGRAPH DATA
                             TP=  3.04     CP= .45     NTA=  0

                                   RECESSION DATA
                       STRTQ=    -1.50     QRCSN=     -.05     RTIOR= 2.00

         UNIT HYDROGRAP 55 END-OF-PERIOD ORDINATES, LAG=   3.05 HOURS, CP=  .45  VOL= 1.00
        36.       132.       268.       418.       544.       620.       626.       578.       521.       469.
       422.       380.       343.       309.       278.       250.       225.       203.       183.       165.
       148.       134.       120.       108.        98.        88.        79.        71.        64.        58.
        52.        47.        42.        38.        34.        31.        28.        25.        23.        20.
        18.        16.        15.        13.        12.        11.        10.         9.         8.         7.
         6.         6.         5.         5.         4.

     0                                END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q

                                                                       SUM  24.57   22.18    2.39   190124.
                                                                          ( 624.)( 563.)(  61.)( 5383.71)
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COMBINE HYDROGRAPHS

TOTAL INFLOW HYDROGRAPH FOR STILLWATER LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SWTI	3	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

STILLWATER LAKE OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SWO	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1810.	0

CAPACITY=	0.	1335.	9670.
ELEVATION=	1802.	1810.	1820.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1810.0	60.0	2.7	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1811.5	0.0	0.0	0.

CREST LENGTH AT OR BELOW ELEVATION	140. 1811.5	1000. 1815.0

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SUB-AREA RUNOFF COMPUTATION

INFLOW FROM SOUTH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LNS	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.03	0.00	19.46	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.30	103.00	115.00	125.00	134.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .822

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 4.38 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 80 END-OF-PERIOD ORDINATES, LAG= 4.42 HOURS, CP= .45 VOL= 1.00

5.	17.	35.	56.	80.	101.	119.	131.	136.	133.
124.	116.	108.	100.	93.	87.	81.	75.	70.	65.
61.	57.	53.	49.	46.	43.	40.	37.	34.	32.
30.	28.	26.	24.	22.	21.	19.	18.	17.	16.
15.	14.	13.	12.	11.	10.	10.	9.	8.	8.
7.	7.	6.	6.	5.	5.	5.	4.	4.	4.
4.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.	1.	1.	1.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	CMP Q
									SUM	24.57	22.18	2.39	58136.
										(624.)	(563.)	(61.)	(1646.23)

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SUB-AREA RUNOFF COMPUTATION

INFLOW FROM NORTH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LNN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.27	0.00	19.46	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PAS	R6	R12	R24	R48	R72	R96
0.00	22.30	103.00	115.00	125.00	134.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .822

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 4.51 CP= .45 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 81 END-OF-PERIOD ORDINATES, LAG= 4.53 HOURS, CP= .7 1.00

9.	34.	70.	[illegible]	158.	203.	239.	265.	279.	277.
	243.	227.	212.	197.	184.	171.	160.	149.	139.
130.	121.	113.	105.	98.	91.	85.	79.	74.	69.
64.	60.	56.	52.	49.	45.	42.	39.	37.	34.
32.	30.	28.	26.	24.	23.	21.	20.	18.	17.
16.	15.	14.	13.	12.	11.	10.	10.	9.	8.
8.	7.	7.	6.	6.	6.	5.	5.	5.	4.
4.	4.	3.	3.	3.	3.	3.	2.	2.	2.
2.									

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 24.57 22.18 2.39 .822 1.
(629.[illegible] 568.1[illegible] 61.3[illegible] 3520.9[illegible]

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Lake Naomi
Hydrology / Hydraulics

COMBINE HYDROGRAPHS

LAKE NAOMI TOTAL INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LNT	3	0	0	0	0	0	0	1

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HYDROGRAPH ROUTING

LAKE NAOMI OUTFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LNO	1	0	0	0	0	0	0	1

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1755.	-1

STAGE	1755.00	1756.00	1757.00	1758.00	1759.00	1761.00	1763.00	1765.00
FLOW	0.00	309.00	874.00	1605.00	2471.00	4540.00	6989.00	9768.00
CAPACITY=	0.	1492.	2832.	4422.				
ELEVATION=	1742.	1755.	1760.	1765.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1755.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1755.4	0.0	0.0	0.

CREST LENGTH AT OR BELOW ELEVATION	0.	350.	650.	2500.	3000.
	1755.4	1755.7	1758.9	1760.0	1765.0

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HYDROGRAPH ROUTING

CHANNEL ROUTING OF LAKE NAOMI OUTFLOW

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LND	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ALMAX	RLNTH	SEL
.0650	.0450	.0650	1720.0	1740.0	9750.	.00800

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 1740.00 850.00 1725.00 975.00 1722.00 975.00 1720.00 1025.00 1720.00
1025.00 1722.00 1125.00 1725.00 2000.00 1740.00

STORAGE	0.00	11.78	23.65	46.59	88.14	148.59	234.77	349.48	492.70	664.45
	864.72	1093.51	1350.82	1636.65	1951.00	2293.88	2665.27	3065.19	3493.63	3950.59
OUTFLOW	0.00	156.92	486.58	1027.76	1945.95	3349.68	5381.23	8309.72	12292.42	17477.36
	24003.97	32004.55	41605.45	52928.04	66089.43	81202.97	98378.75	117723.90	139342.94	163337.97
STAGE	1720.00	1721.05	1722.11	1723.16	1724.21	1725.26	1726.32	1727.37	1728.42	1729.47
	1730.53	1731.58	1732.63	1733.68	1734.74	1735.79	1736.84	1737.89	1738.95	1740.00
FLOW	0.00	156.92	486.58	1027.76	1945.95	3349.68	5381.23	8309.72	12292.42	17477.36
	24003.97	32004.55	41605.45	52928.04	66089.43	81202.97	98378.75	117723.90	139342.94	163337.97

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

PLAN 1 - no upstream dam failures

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 .90	RATIO 6 1.00
HYDROGRAPH AT	LLI	3.39	1	535.	1605.	2676.	3746.	4816.	5352.
	(	8.78)	(	15.15)(	45.46)(	75.77)(	106.08)(	136.39)(	151.54)(
ROUTED TO	LLO	3.39	1	513.	1580.	2657.	3726.	4790.	5321.
	(	8.78)	(	14.51)(	44.75)(	75.25)(	105.50)(	135.62)(	150.66)(
HYDROGRAPH AT	PSI	3.21	1	414.	1241.	2069.	2896.	3724.	4137.
	(	8.31)	(	11.72)(	35.15)(	58.58)(	82.01)(	105.44)(	117.16)(
ROUTED TO	PSO	3.21	1	141.	1130.	1992.	2827.	3656.	4070.
	(	8.31)	(	3.98)(	32.00)(	56.40)(	80.06)(	103.53)(	115.24)(
HYDROGRAPH AT	SWI	6.56	1	980.	2940.	4900.	6860.	8819.	9799.
	(	16.99)	(	27.75)(	83.25)(	138.74)(	194.24)(	249.74)(	277.49)(
3 COMBINED	SWTI	13.16	1	1529.	5321.	9292.	13148.	16965.	18872.
	(	34.08)	(	43.30)(	150.68)(	263.13)(	372.31)(	480.41)(	534.39)(
ROUTED TO	SWO	13.16	1	223.	2409.	5824.	9651.	13650.	15687.
	(	34.08)	(	6.32)(	68.23)(	164.92)(	273.28)(	386.54)(	444.19)(
HYDROGRAPH AT	LNS	2.03	1	233.	699.	1165.	1631.	2097.	2330.
	(	5.26)	(	6.60)(	19.79)(	32.98)(	46.18)(	59.37)(	65.96)(
HYDROGRAPH AT	LNN	4.27	1	482.	1445.	2408.	3371.	4334.	4815.
	(	11.06)	(	13.64)(	40.91)(	68.18)(	95.45)(	122.72)(	136.36)(
3 COMBINED	LNT	19.46	1	804.	3835.	8825.	14265.	19850.	22575.
	(	50.40)	(	22.77)(	108.59)(	249.91)(	403.95)(	562.10)(	639.27)(
ROUTED TO	LNO	19.46	1	633.	3757.	8641.	14098.	19708.	22526.
	(	50.40)	(	17.92)(	106.39)(	244.69)(	399.21)(	558.07)(	637.87)(
ROUTED TO	LND	19.46	1	630.	3737.	8573.	13960.	19547.	22330.
	(	50.40)	(	17.83)(	105.82)(	242.77)(	395.29)(	553.52)(	632.30)(

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PLAN 1

SUMMARY OF DAM SAFETY ANALYSIS

LYNCHWOOD LAKE

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1881.00	1881.00	1883.00
STORAGE	285.	285.	399.
OUTFLOW	0.	0.	1741.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1882.19	0.00	353.	513.	0.00	43.50	0.00
.30	1882.91	0.00	395.	1580.	0.00	43.00	0.00
.50	1883.39	.39	422.	2657.	4.50	43.00	0.00
.70	1883.71	.71	440.	3726.	7.50	43.00	0.00
.90	1883.95	.95	454.	4790.	9.00	43.00	0.00
1.00	1884.05	1.05	460.	5321.	10.00	43.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS

POCONO SUMMIT

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1825.00	1825.00	1826.50
STORAGE	215.	215.	440.
OUTFLOW	0.	0.	121.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1826.54	.04	446.	141.	5.50	51.50	0.00
.30	1827.18	.68	541.	1130.	20.50	45.00	0.00
.50	1827.51	1.01	591.	1992.	25.00	44.50	0.00
.70	1827.77	1.27	631.	2827.	28.50	44.00	0.00
.90	1828.01	1.51	666.	3656.	30.50	44.00	0.00
1.00	1828.11	1.61	682.	4070.	32.00	44.00	0.00

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PLAN 1

SUMMARY OF DAM SAFETY ANALYSIS

STILLWATER LAKE

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1810.00	1810.00	1811.50
STORAGE	1335.	1335.	2585.
OUTFLOW	0.	0.	298.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1811.24	0.00	2367.	223.	0.00	57.00	0.00
.30	1813.00	1.50	3834.	2409.	38.50	49.00	0.00
.50	1814.01	2.51	4675.	5824.	43.50	46.50	0.00
.70	1814.76	3.26	5304.	9651.	47.00	45.50	0.00
.90	1815.37	3.87	5814.	13650.	49.00	45.00	0.00
1.00	1815.64	4.14	6039.	15687.	50.50	45.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS

LAKE NAOMI DAM

	INITIAL VALUE	SPILLWAY CREST	~~TOP OF DAM~~
ELEVATION	1755.00	1755.00	1755.40
STORAGE	1492.	1492.	1599.
OUTFLOW	0.	0.	124.

auxiliary spillway crest; embankment low point, 1758.9

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1755.99	.59	1759.	633.	58.00	48.50	0.00
.30	1757.24	1.84	2094.	3757.	61.50	48.50	0.00
.50	1758.44	3.04	2414.	8641.	64.00	47.00	0.00
.70	1759.38	3.98	2667.	14098.	66.00	46.00	0.00
.90	1759.96	4.56	2821.	19708.	67.50	45.00	0.00
1.00	1760.18	4.78	2888.	22526.	68.50	45.00	0.00

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

PLAN 2

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .10	RATIO 2 .30	RATIO 3 .50	RATIO 4 .70	RATIO 5 .90	RATIO 6 1.00
HYDROGRAPH AT	LLI	3.39	1	535.	1605.	2676.	3746.	4816.	5352.
		(8.78)	(	15.15)(	45.46)(	75.77)(	106.08)(	136.39)(	151.54)(
ROUTED TO	LLO	3.39	1	513.	1582.	3950.	5131.	5736.	5758.
Failure assumed		(8.78)	(	14.51)(	44.81)(	111.84)(	145.28)(	162.42)(	163.04)(
HYDROGRAPH AT	PSI	3.21	1	414.	1241.	2069.	2896.	3724.	4137.
		(8.31)	(	11.72)(	35.15)(	58.58)(	82.01)(	105.44)(	117.16)(
ROUTED TO	PSO	3.21	1	141.	1130.	2225.	3175.	4034.	4438.
Failure assumed		(8.31)	(	3.98)(	31.99)(	62.99)(	89.92)(	114.23)(	125.67)(
HYDROGRAPH AT	SWI	6.56	1	980.	2940.	4900.	6860.	8819.	9799.
		(16.99)	(	27.75)(	83.25)(	138.74)(	194.24)(	249.74)(	277.49)(
3 COMBINED	SWTI	13.16	1	1529.	5322.	10873.	14193.	18379.	19693.
		(34.08)	(	43.30)(	150.71)(	307.90)(	401.91)(	520.44)(	557.65)(
ROUTED TO	SWO	13.16	1	223.	2410.	6437.	10369.	14456.	16353.
No failure assumed		(34.08)	(	6.32)(	68.24)(	182.29)(	293.61)(	409.35)(	463.05)(
HYDROGRAPH AT	LNS	2.03	1	233.	699.	1165.	1631.	2097.	2330.
		(5.26)	(	6.60)(	19.79)(	32.98)(	46.18)(	59.37)(	65.96)(
HYDROGRAPH AT	LNN	4.27	1	482.	1445.	2408.	3371.	4334.	4815.
		(11.06)	(	13.64)(	40.91)(	68.18)(	95.45)(	122.72)(	136.36)(
3 COMBINED	LNT	19.46	1	804.	3835.	9495.	15014.	20656.	23350.
		(50.40)	(	22.77)(	108.60)(	268.86)(	425.16)(	584.92)(	661.20)(
ROUTED TO	LNO	19.46	1	633.	3757.	9259.	14831.	20583.	23279.
No failure assumed		(50.40)	(	17.92)(	106.40)(	262.19)(	419.96)(	582.85)(	659.20)(
ROUTED TO	LND	19.46	1	630.	3737.	9185.	14680.	20410.	23056.
		(50.40)	(	17.83)(	105.83)(	260.09)(	415.68)(	577.95)(	652.86)(

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PLAN 2

SUMMARY OF DAM SAFETY ANALYSIS

LYNCHWOOD LAKE - Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	TOP OF ~~DAM~~ Emergency Spillway Crest
ELEVATION	1881.00	1881.00	1881.50
STORAGE	285.	285.	314.
OUTFLOW	0.	0.	22.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER ~~TOP~~ HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1882.19	.69	353.	513.	24.50	43.50	0.00
.30	1882.91	1.41	395.	1582.	37.50	43.00	0.00
.50	1883.17	1.67	409.	4116.	15.50	43.25	41.50
.70	1883.13	1.63	407.	5131.	21.25	42.50	40.50
.90	1883.16	1.66	409.	6062.	22.00	42.25	40.00
1.00	1883.05	1.55	402.	6047.	21.92	41.75	39.50

SUMMARY OF DAM SAFETY ANALYSIS

POCONO SUMMIT - Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1825.00	1825.00	1826.50
STORAGE	215.	215.	440.
OUTFLOW	0.	0.	121.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1826.54	.04	446.	141.	5.50	51.50	0.00
.30	1827.18	.68	541.	1130.	20.50	45.00	0.00
.50	1827.51	1.01	591.	2225.	7.75	45.00	44.00
.70	1827.66	1.16	615.	3180.	8.00	44.25	42.50
.90	1827.7	1.24	626.	4039.	8.50	44.25	41.50
1.00	1827.84	1.34	641.	4438.	9.00	44.00	41.50

MFB 6/4/79
REV 9/25/79

Lake Naomi
Hydrology / Hydraulics

SH. 24 OF 27

MFB 6/4/79 Lake Naomi Hydrology / Hydraulics

SH. 25 OF 27

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 2

STILLWATER LAKE - No Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1810.00	1810.00	1811.50
STORAGE	1335.	1335.	2585.
OUTFLOW	0.	0.	298.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1811.24	0.00	2367.	223.	0.00	57.00	0.00
.30	813.00	1.50	3834.	2410.	38.50	49.00	0.00
.50	1814.14	2.64	4790.	6437.	40.50	46.50	0.00
.70	1814.88	3.38	5404.	10369.	43.50	45.50	0.00
.90	1815.48	3.98	5906.	14456.	46.00	45.00	0.00
1.00	1815.73	4.23	6109.	16353.	47.00	45.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS

LAKE NAOMI DAM - No Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	~~TOP OF DAM~~	auxiliary spillway
ELEVATION	1755.00	1755.00	1755.40	crest; embankment
STORAGE	1492.	1492.	1599.	low point, 1758.9
OUTFLOW	0.	0.	124.	

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1755.99	.59	1759.	633.	58.00	48.50	0.00
.30	1757.24	1.84	2094.	3757.	61.50	48.50	0.00
.50	1758.57	3.17	2448.	9259.	64.00	47.00	0.00
.70	1759.47	4.07	2691.	14831.	66.00	45.50	0.00
.90	1760.03	4.63	2841.	20583.	67.50	45.00	0.00
1.00	1760.23	4.83	2905.	23279.	68.50	45.00	0.00

PLAN 3
Upstream dams failed

SUMMARY OF DAM SAFETY ANALYSIS

STILLWATER LAKE - No Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1810.00	1810.00	1811.50
STORAGE	1335.	1335.	2585.
OUTFLOW	0.	0.	298.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1811.24	0.00	2367.	223.	0.00	57.00	0.00
.30	1813.00	1.50	3834.	2410.	38.50	49.00	0.00
.50	1814.14	2.64	4790.	6437.	40.50	46.50	0.00
.70	1814.88	3.38	5404.	10369.	43.50	45.50	0.00
.90	1815.48	3.98	5906.	14456.	46.00	45.00	0.00
1.00	1815.73	4.23	6109.	16353.	47.00	45.00	0.00

SUMMARY OF DAM SAFETY ANALYSIS

LAKE NAOMI - Failure Assumed

	INITIAL VALUE	SPILLWAY CREST	~~TOP OF DAM~~
ELEVATION	1755.00	1755.00	1755.40
STORAGE	1492.	1492.	1599.
OUTFLOW	0.	0.	124.

auxiliary spillway crest; embankment low point, 1758.9

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1755.99	.59	1759.	633.	58.00	48.50	0.00
.30	1757.24	1.84	2094.	3757.	61.50	48.50	0.00
.50	1758.30	2.90	2377.	9629.	20.00	46.75	43.50
.70	1759.25	3.85	2630.	15085.	23.50	45.75	42.50
.90	1759.87	4.47	2796.	20734.	26.50	45.25	42.00
1.00	1760.07	4.67	2853.	23413.	28.00	45.00	41.50

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PLAN 1 STATION LND

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	630.	1722.4	49.00
.30	3737.	1725.5	49.00
.50	8573.	1727.4	47.50
.70	13960.	1728.8	46.50
.90	19547.	1729.8	45.50
1.00	22330.	1730.3	45.50

PLAN 2 STATION LND

DOWNSTREAM OF LAKE NAOMI DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	630.	1722.4	49.00
.30	3737.	1725.5	49.00
.50	9185.	1727.6	47.50
.70	14680.	1728.9	46.00
.90	20410.	1729.9	45.50
1.00	23056.	1730.4	45.50

PLAN 3 STATION LND

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.10	630.	1722.4	49.00
.30	3737.	1725.5	49.00
.50	9546.	1727.7	47.50
.70	14926.	1729.0	46.50
.90	20547.	1730.0	45.50
1.00	23207.	1730.4	45.50

CHANNEL ROUTING OF LAKE NAOMI OUTFLOW

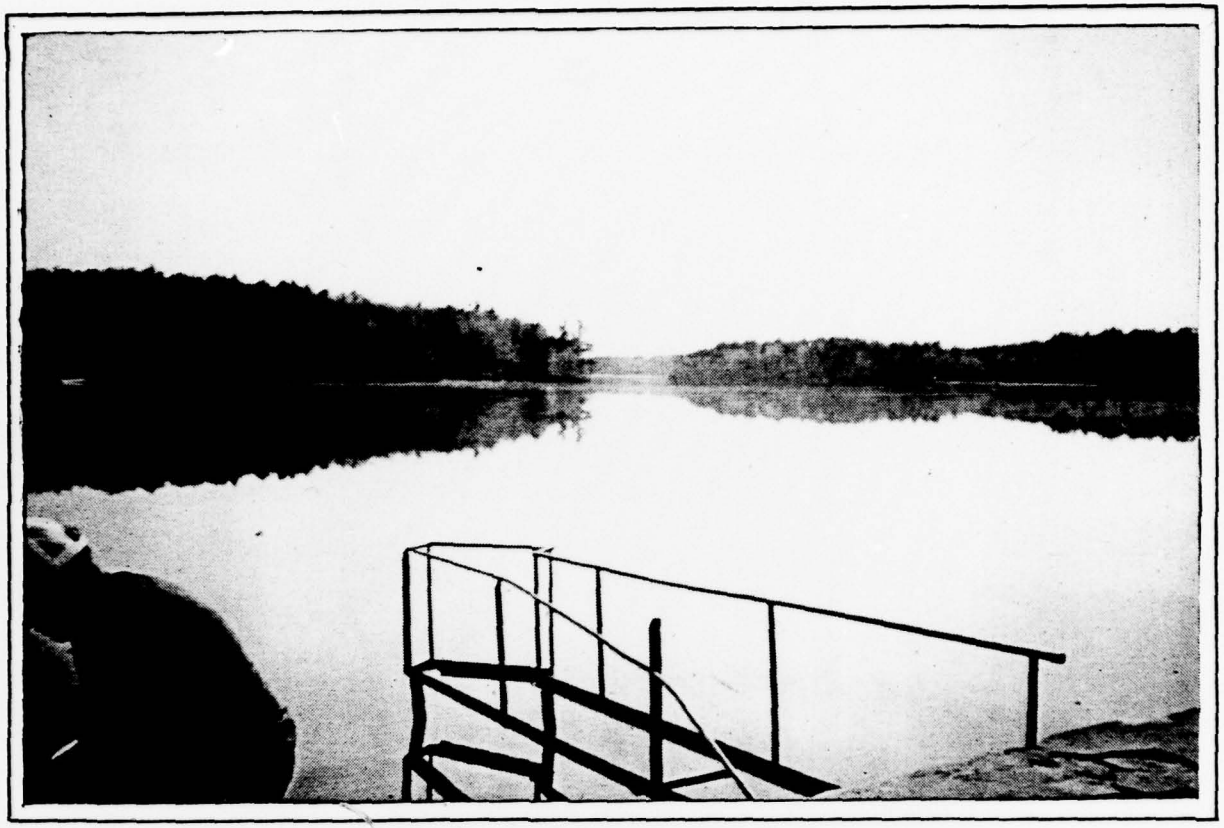
Plan 1 - No failures assumed.

Plan 2 - Failure of upstream Lynchwood Pocono Summit assumed.

Plan 3 - Failure of Lynchwood, Pocono Summit and Lake Naomi assumed.

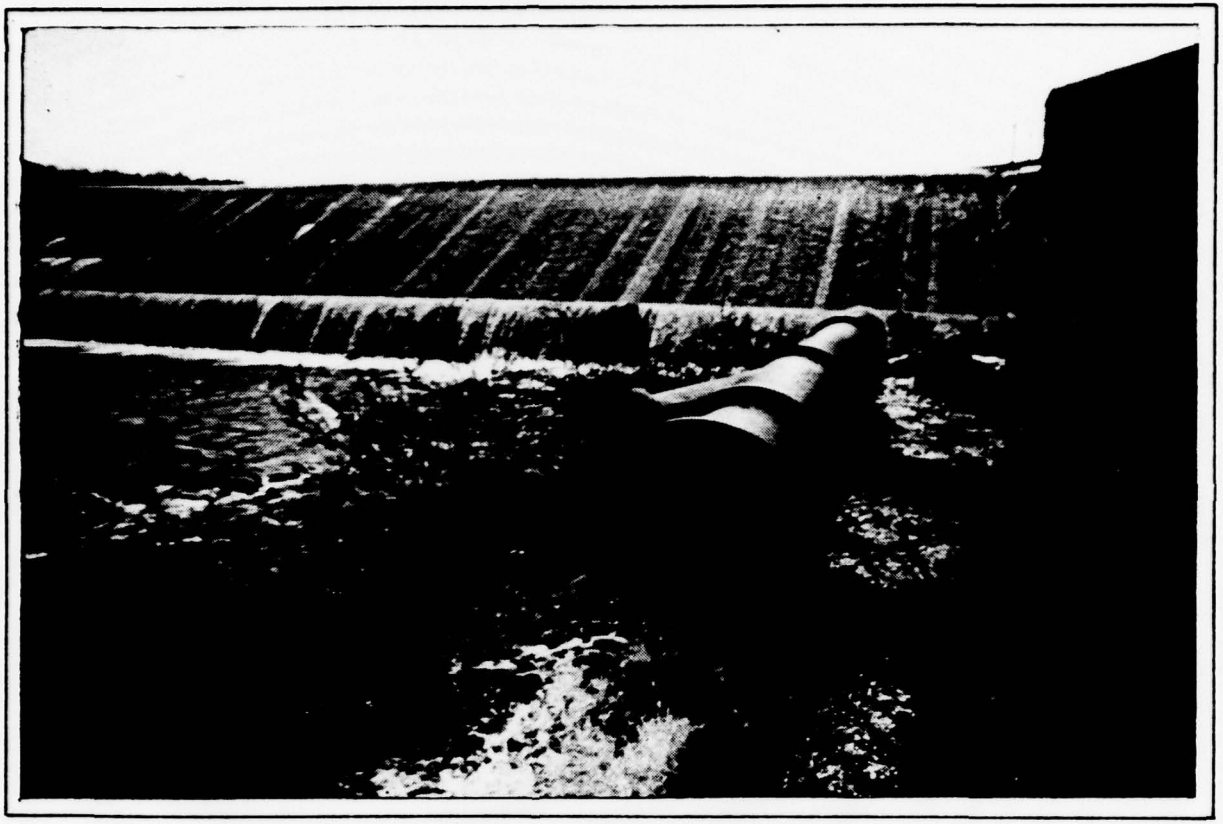
APPENDIX

D



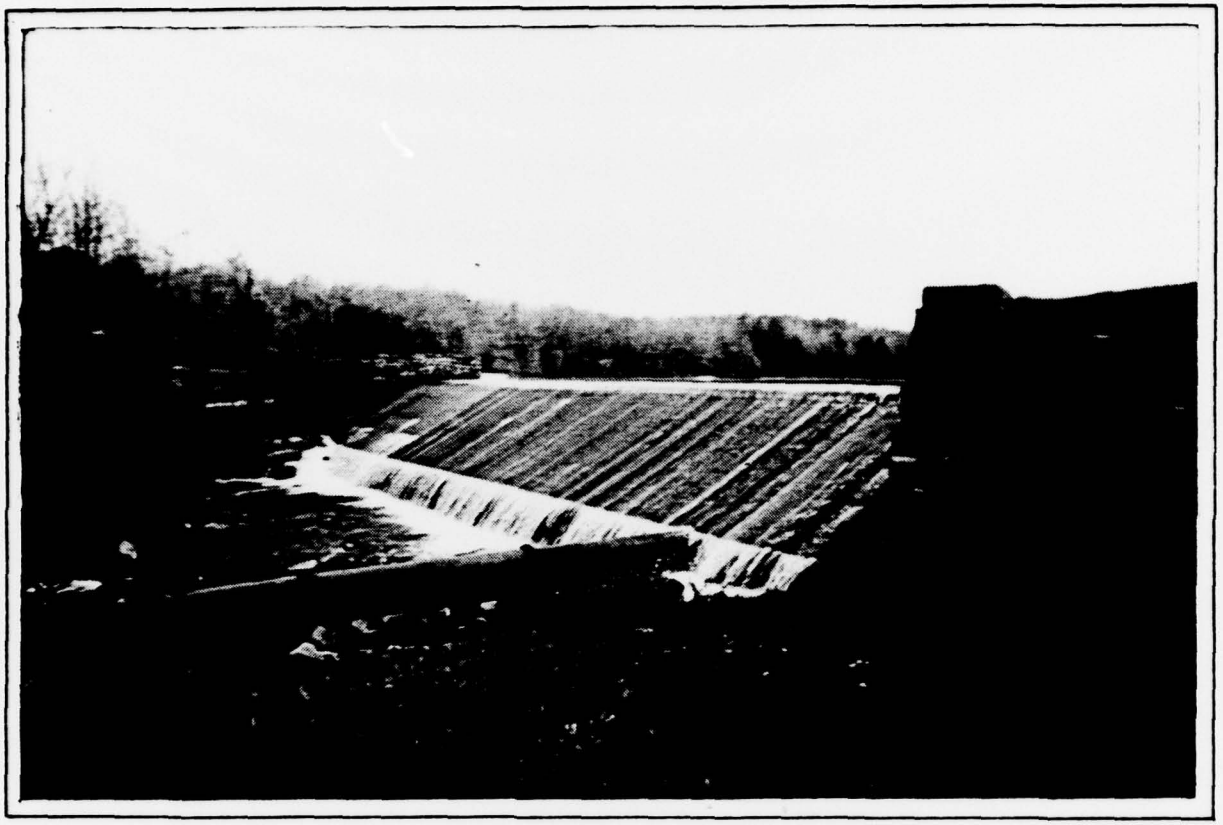
ACCESS BRIDGE TO OUTLET PIPE VALVE STEM. STEM IS LOCATED BELOW WATER. NOTE CONDITION OF BRIDGE.

PHOTOGRAPH NO. 1



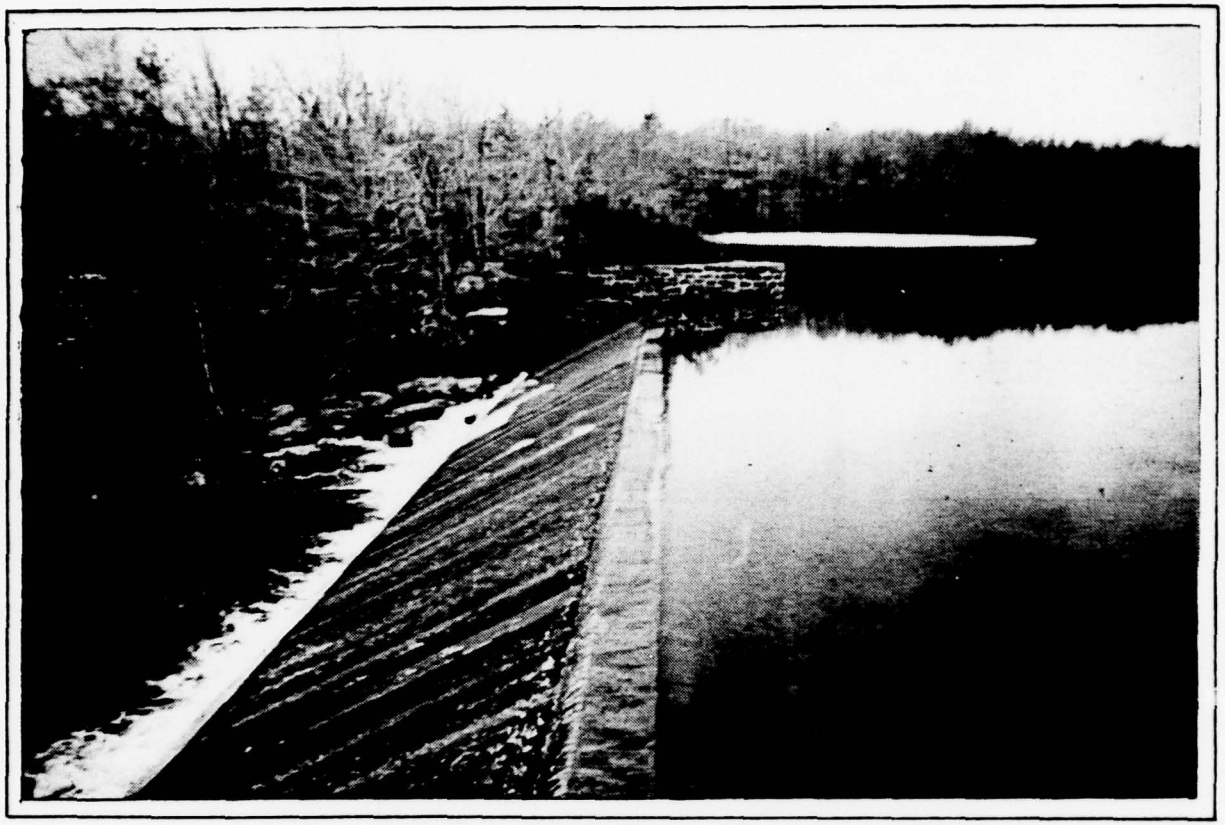
OUTLET PIPE AND VIEW OF SPILLWAY.

PHOTOGRAPH NO. 2



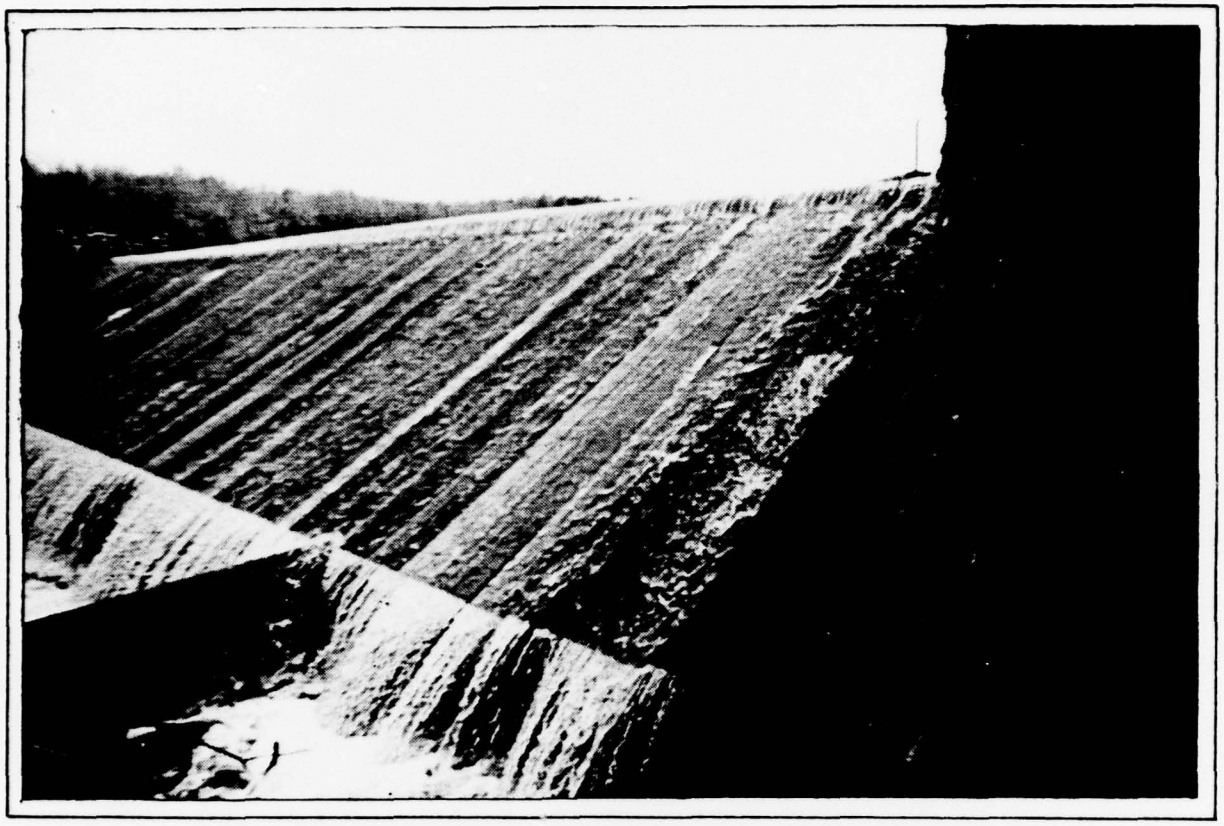
OVERVIEW OF SPILLWAY LOOKING FROM
LEFT ABUTMENT.

PHOTOGRAPH NO. 3



OVERVIEW OF WOODEN SPILLWAY AND
WEIR.

PHOTOGRAPH NO. 4



OVERVIEW OF WOODEN SPILLWAY.

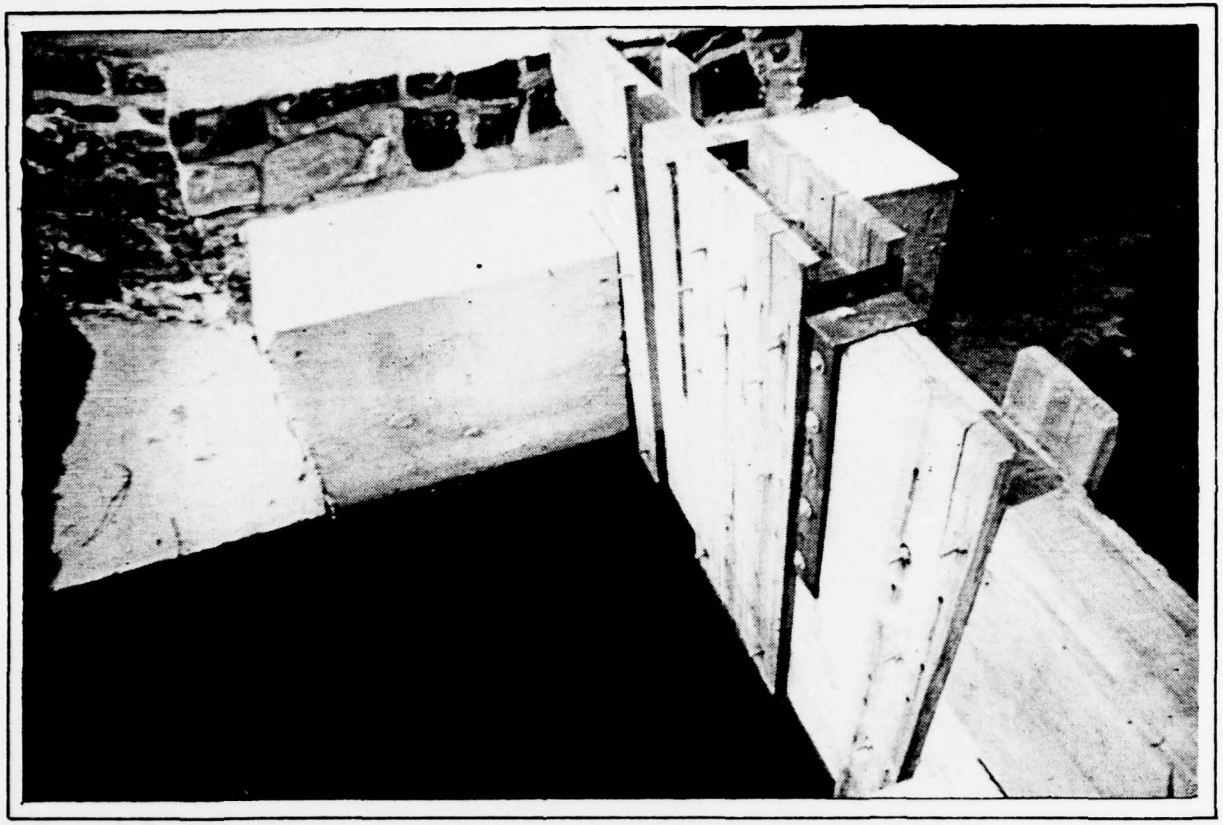
PHOTOGRAPH NO. 5

VIEW OF DOWNSTREAM CHANNEL BELOW
SPILLWAY.

PHOTOGRAPH NO. 6

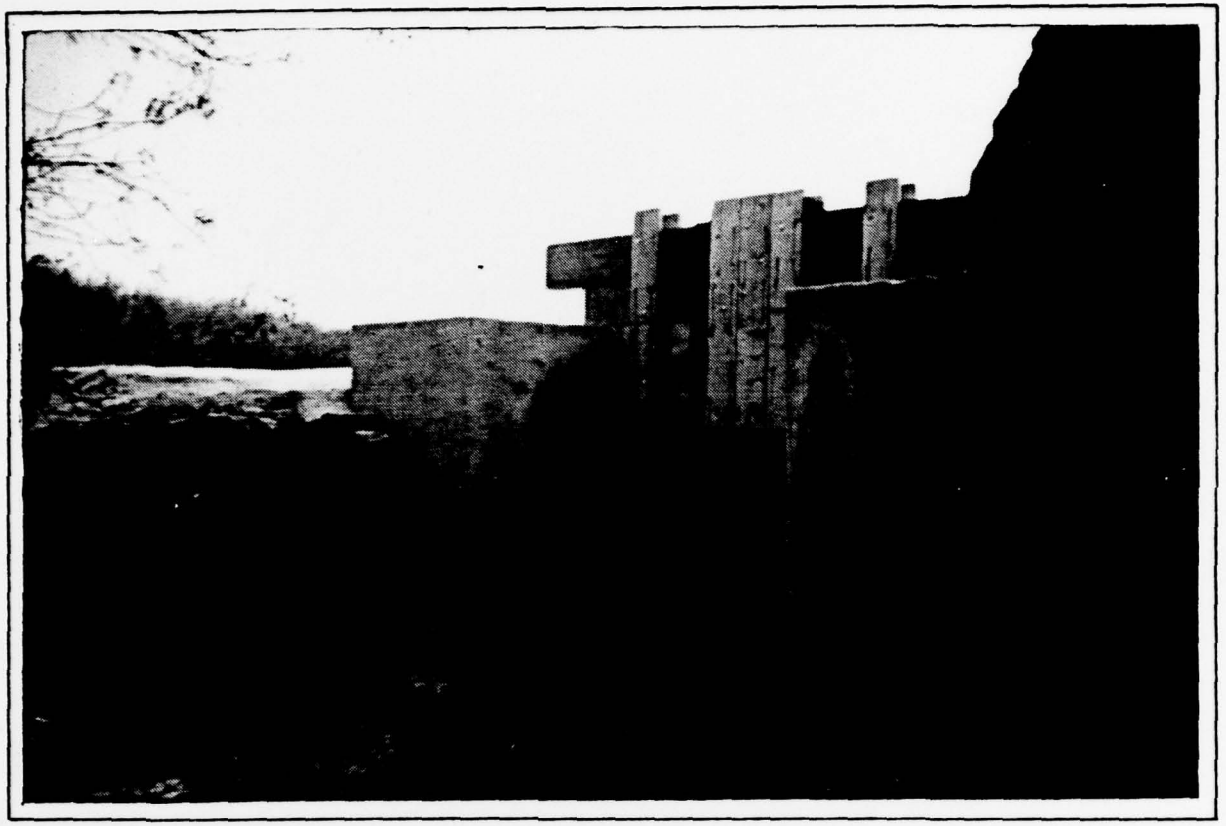
VIEW OF DOWNSTREAM CHANNEL LOOKING
FROM LEFT ABUTMENT OF THE SPILLWAY.

PHOTOGRAPH NO. 7



OVERVIEW OF WOODEN SLUICE GATE.

PHOTOGRAPH NO. 8

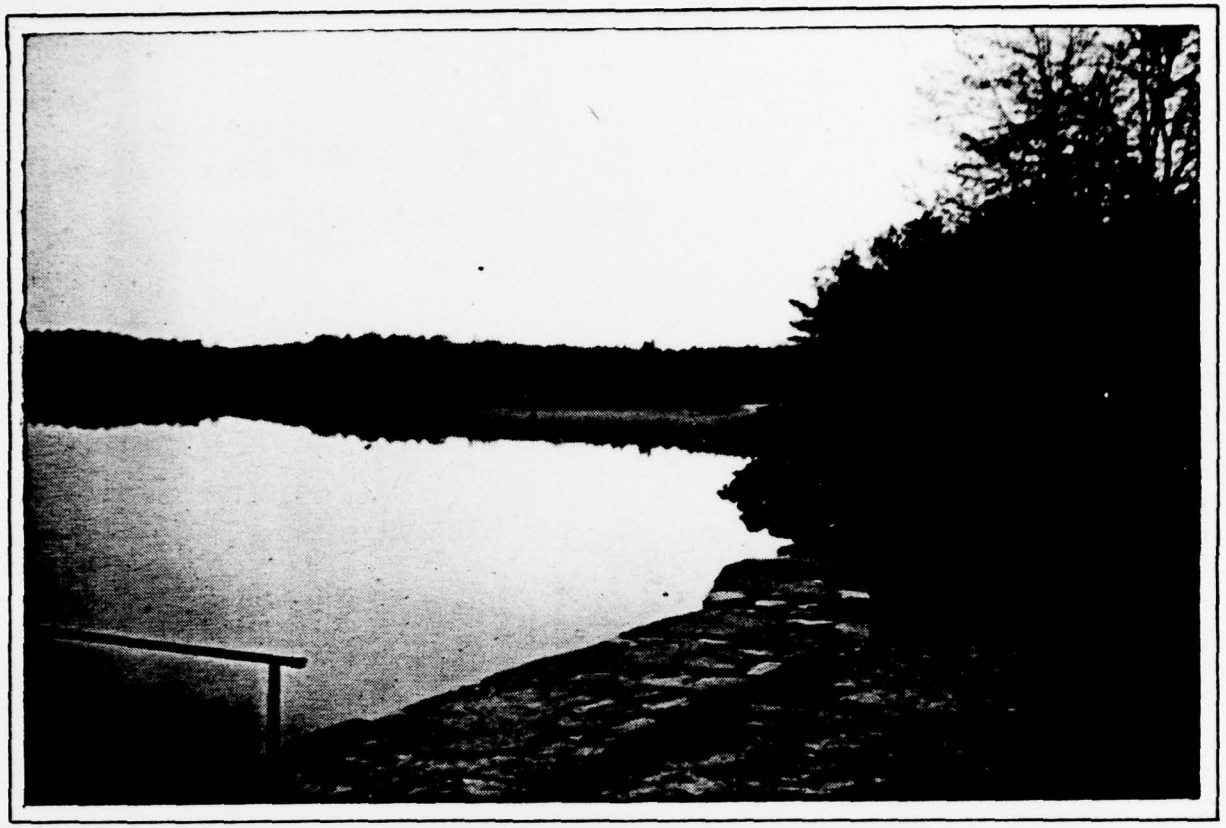


WOODEN SLUICE GATE LOOKING UPSTREAM.

PHOTOGRAPH NO. 9

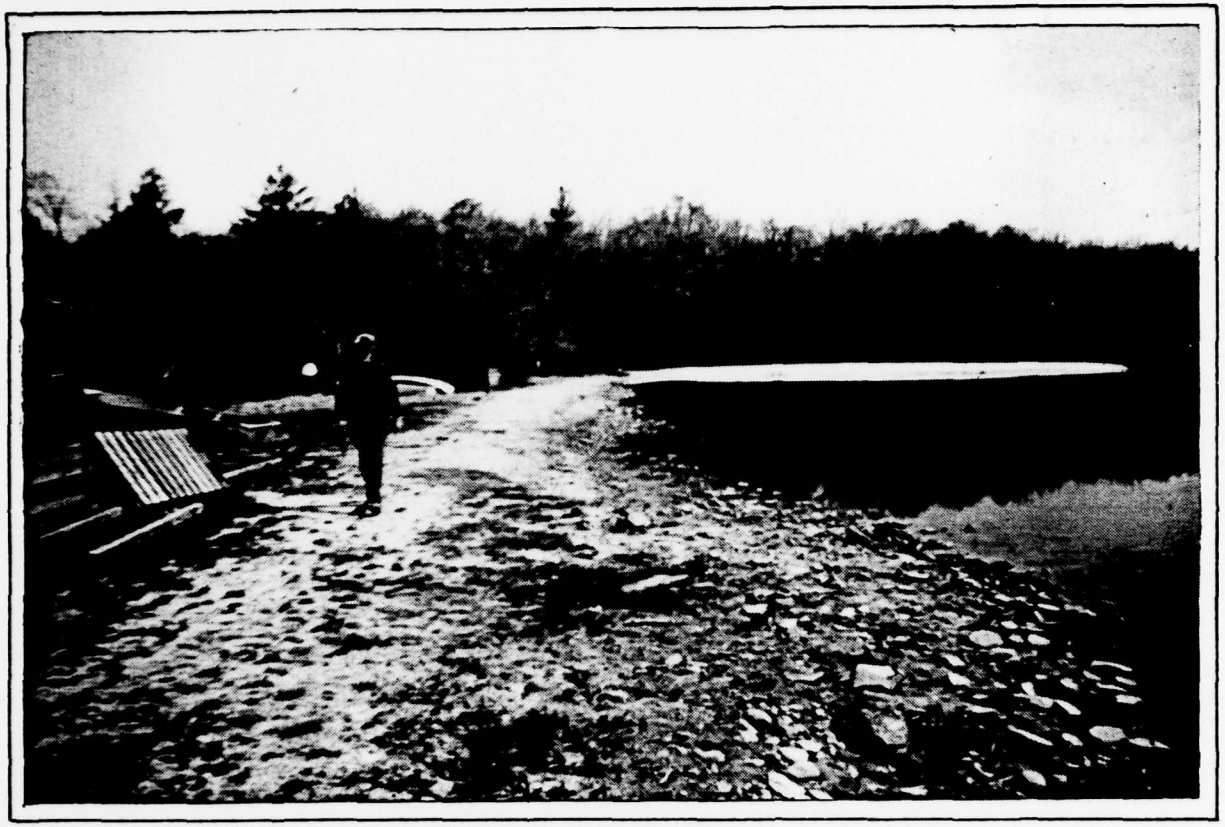
VIEW OF LEAKAGE THROUGH BASE OF
SLUICE GATE AT LEFT ABUTMENT WALL.

PHOTOGRAPH NO. 10



OVERVIEW OF LEFT ABUTMENT WALL OF SPILLWAY.

PHOTOGRAPH NO. 11



SHORELINE ON RIGHT SIDE OF SPILLWAY
LOOKING FROM RIGHT ABUTMENT OF
WOODEN SLUICE GATE. THIS IS THE
AUXILLARY SPILLWAY.

PHOTOGRAPH NO. 12

AREA DOWNSTREAM OF AUXILLARY SPILLWAY SHOWN IN PHOTOGRAPH NO. 12. NOTE THAT FILL WAS NOT COMPACTED OR FOUNDATION PREPARED.

PHOTOGRAPH NO. 13

VIEW OF GENERAL CONDITION OF FILL
BELOW AUXILLARY SPILLWAY SHOWN IN
PHOTOGRAPH NO. 12.

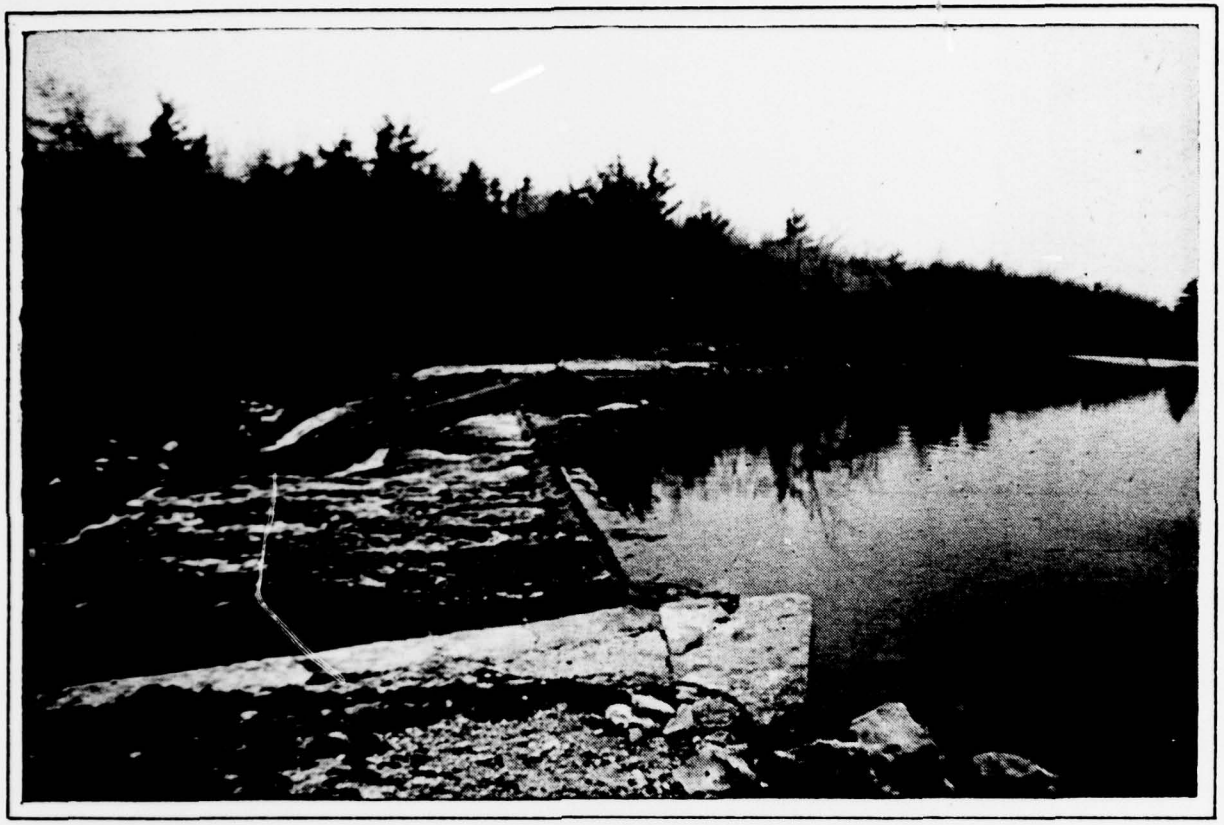
PHOTOGRAPH NO. 14.

TYPICAL VIEW OF SEEPAGE BENEATH/
THROUGH AUXILLARY SPILLWAY.

PHOTOGRAPH NO. 15

ANOTHER VIEW OF THE SEEPAGE BENEATH/
THROUGH THE AUXILLARY SPILLWAY.

PHOTOGRAPH NO. 16



VIEW OF STILLWATER LAKE DAM UPSTREAM
OF LAKE NAOMI DAM.

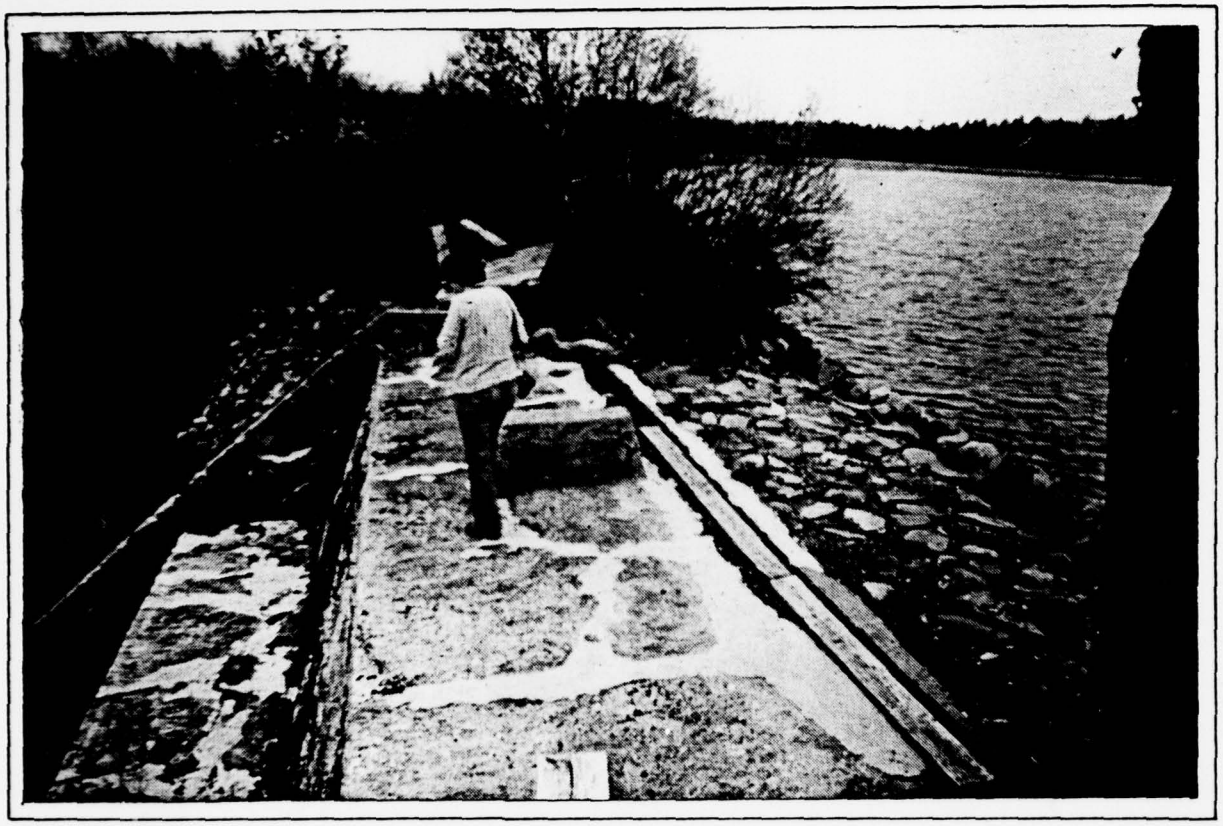
PHOTOGRAPH NO. 17

VIEW OF POCONO SUMMIT DAM WHICH DRAINS
INTO STILLWATER LAKE DAM.

PHOTOGRAPH NO. 18

VIEW OF LYNCHWOOD LAKE DAM WHICH
DRAINS INTO STILLWATER LAKE DAM.

PHOTOGRAPH NO. 19



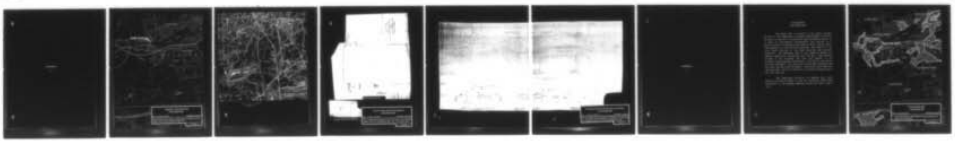
VIEW OF LYNCHWOOD LAKE DAM WHICH
DRAINS INTO STILLWATER LAKE DAM.

PHOTOGRAPH NO. 19

AD-A078 930 WOODWARD-CLYDE CONSULTANTS PLYMOUTH MEETING PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. LAKE NAOMI DAM (NDS ID NUMBER --ETC(U)
JUL 79 J BOSCHUK DACW31-79-C-0017

UNCLASSIFIED NL

2 OF 2
AD A078930



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DATE FILMED
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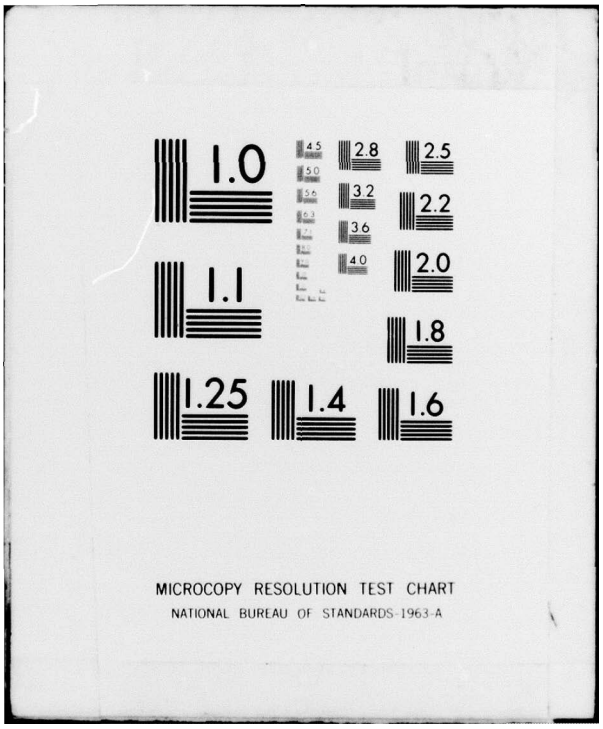
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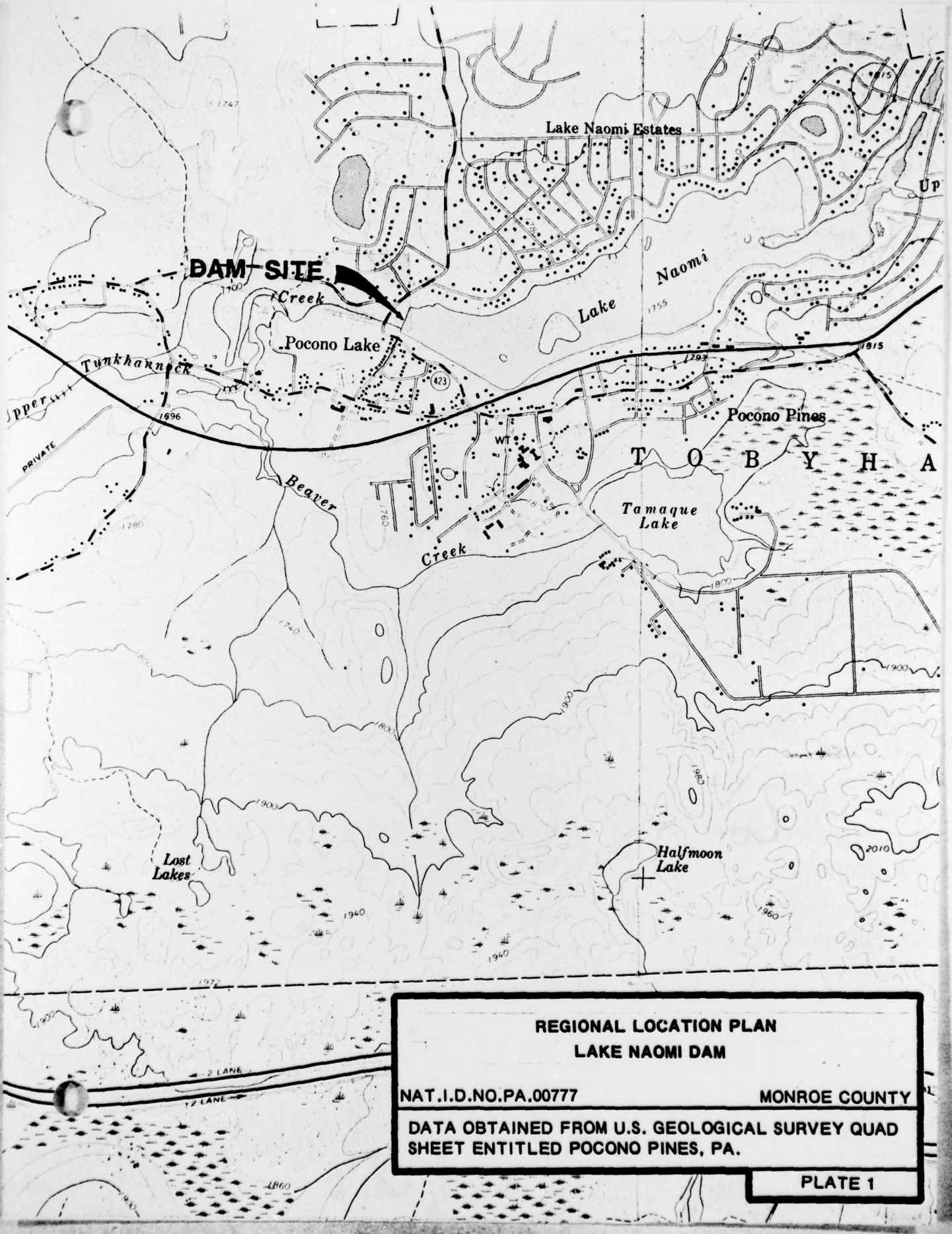
5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX

E



REGIONAL LOCATION PLAN
LAKE NAOMI DAM

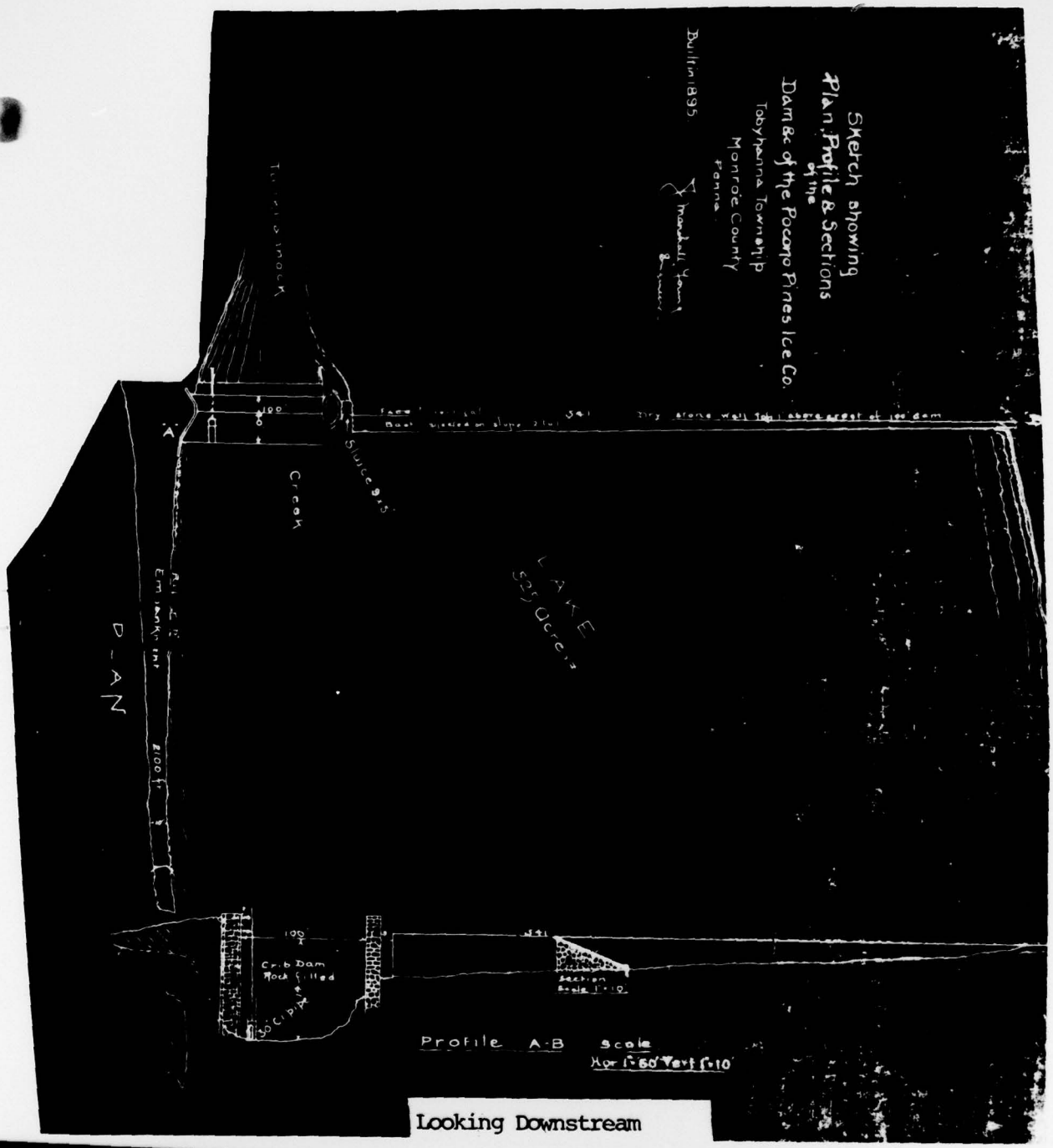
NAT.I.D.NO.PA.00777 MONROE COUNTY

DATA OBTAINED FROM U.S. GEOLOGICAL SURVEY QUAD SHEET ENTITLED POCONO PINES, PA.

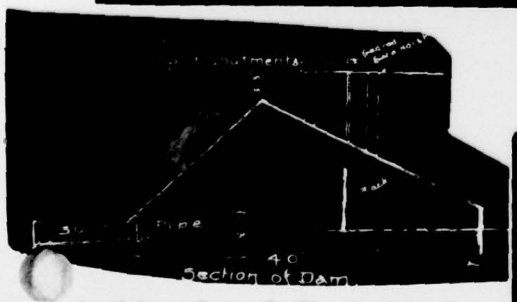
PLATE 1

0 ½ 1 Mile

Scale



Looking Downstream



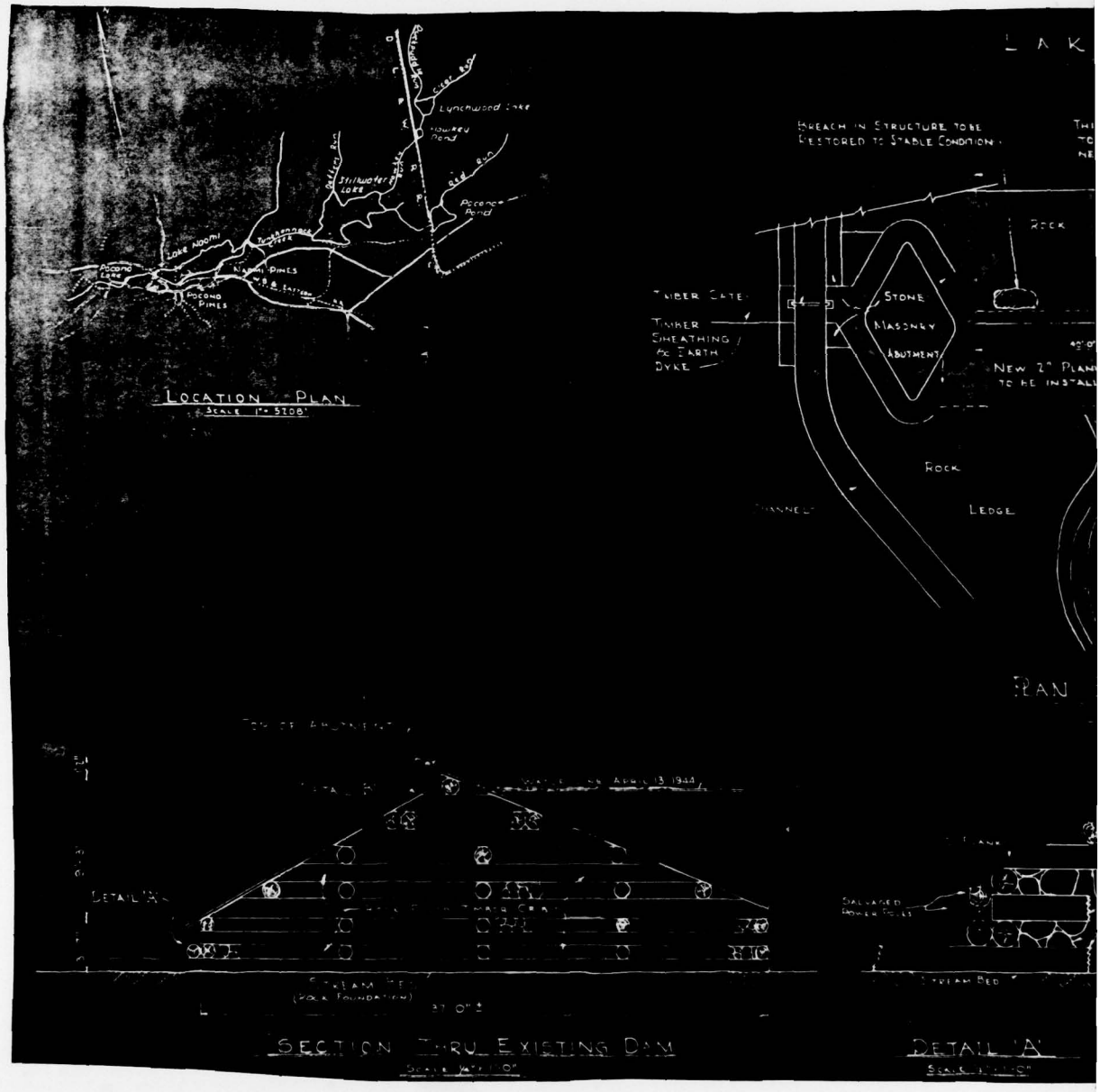
Looking from left abutment

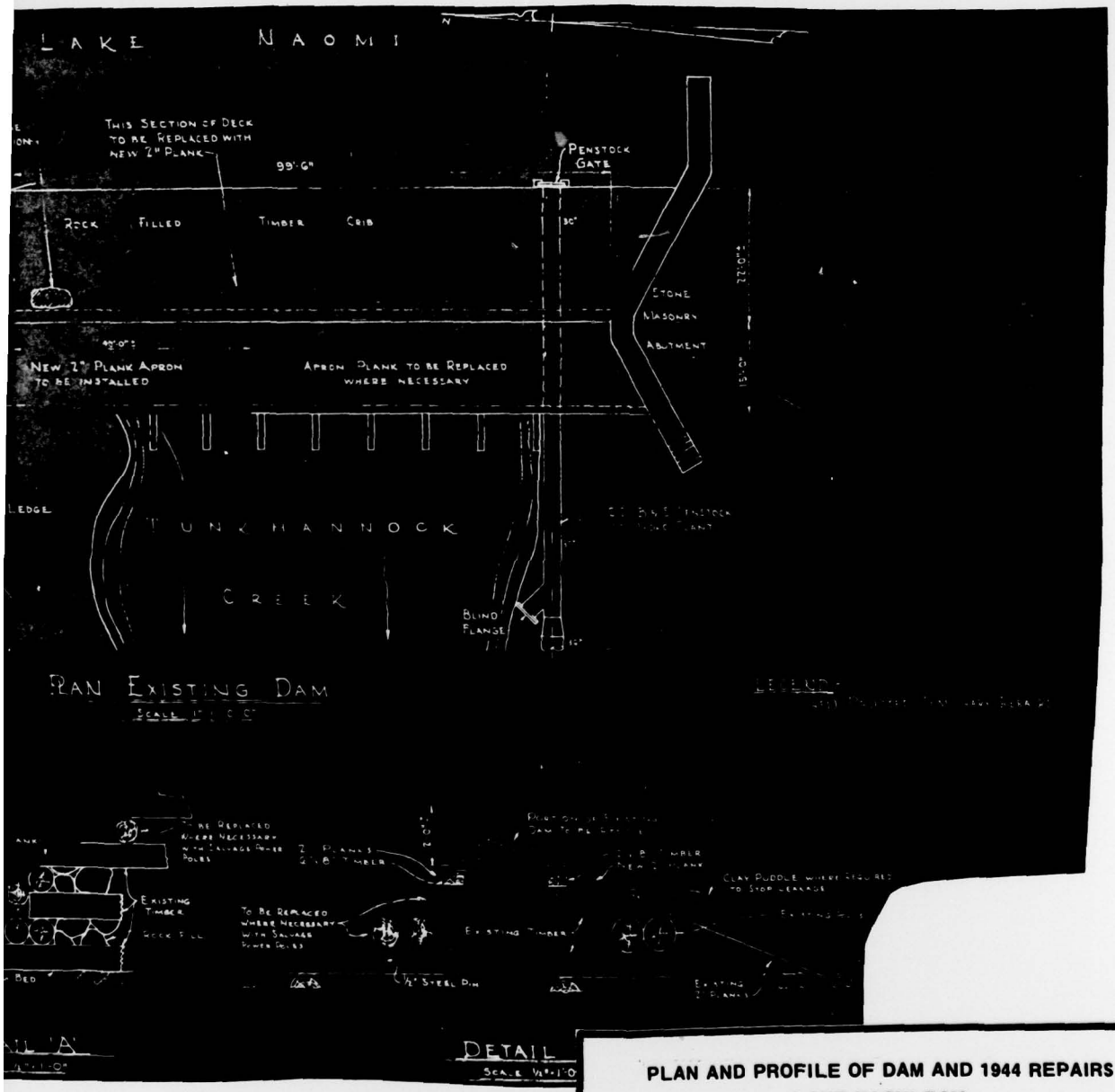
PLAN OF DAM AND APPURTENANCES
LAKE NAOMI DAM

NAT. I.D.NO. PA.00777 **MONROE COUNTY**

DATA OBTAINED FROM SKETCH OF DAM OF THE POCONO PINES ICE CO. TOBYHANNA TWP., PA. J.M.YOUNG, ENG.

PLATE 2


LAK
Lynchwood Lake
Stillwater Lake
Pocono Pond
Lake Naomi
Naomi Pines
Pocono Lake
Pocono Pines
LOCATION PLAN
SCALE 1" = 5700'
BREACH IN STRUCTURE TO BE RESTORED TO STABLE CONDITION
TIMBER GATE
TIMBER SHEATHING TO EARTH DYKE
STONE MASONRY ABUTMENT
ROCK
NEW 2" PLAN
ROCK
LEDGE
PLAN
DETAIL 'A'
SALVAGED POWER POLES
STREAM BED
SECTION THRU EXISTING DAM
DETAIL 'A'



PLAN AND PROFILE OF DAM AND 1944 REPAIRS
LAKE NAOMI DAM

NAT. I.D.NO.PA.007777 MONROE COUNTY

DATA OBTAINED FROM DRAWING SHOWING LOCATION PLAN OF LAKE NAOMI DAM, DRAWING NO. DB939P25, TOBYHANNA TWP., MONROE COUNTY, PA. DATED APRIL 18,1944

PLATE 3

2

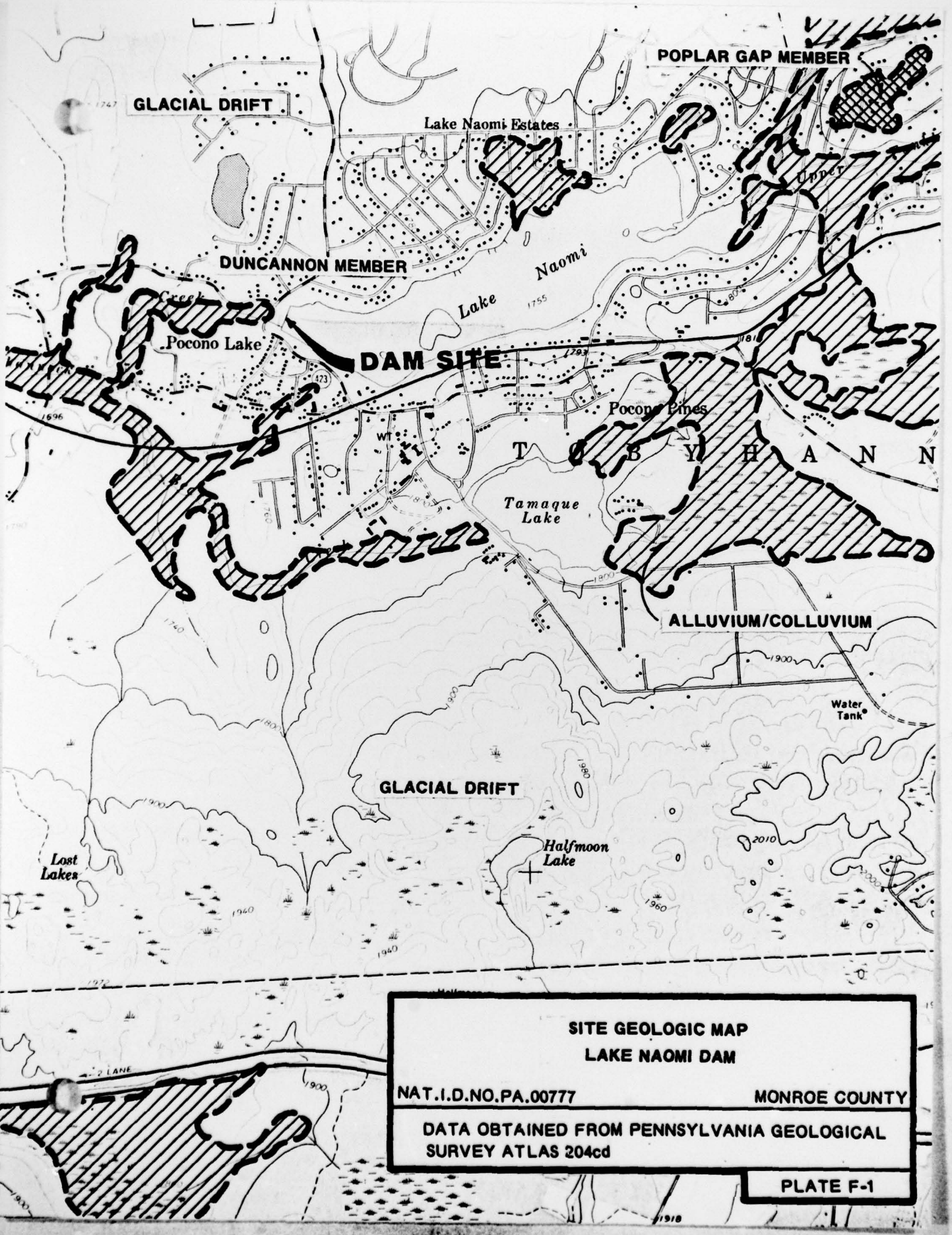
APPENDIX

F

SITE GEOLOGY
LAKE NAOMI DAM

Lake Naomi Dam is located in the Pocono Plateau Section of the Appalachian Plateaus Physiographic Province. As shown on Plate F-1, the dam site and surrounding region, as is much of northeastern Pennsylvania, are overlain by a partial mantle of Wisconsin age glacial drift, having localized deposits of alluvium and colluvium. The bedrock in the site region belongs to the Upper Devonian age Catskill Formation. The sandstone beds of the Duncannon Member are exposed immediately downstream from the dam. Rock bedding strikes to the northeast and dips nine degrees to the northwest (approximately downstream). Two sets of rock joints are well developed. One joint set strikes east-northeast and the other strikes north-northwest. Both joint sets have near vertical dips. This has resulted in an overall blocky form to the rock outcrops.

The downstream direction of bedding dip, joint pattern and shallow depth to rock are conditions which could contribute to the seepage observed during the field inspection.



SITE GEOLOGIC MAP
LAKE NAOMI DAM

NAT.I.D.NO.PA.00777 **MONROE COUNTY**

DATA OBTAINED FROM PENNSYLVANIA GEOLOGICAL SURVEY ATLAS 204cd

PLATE F-1